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THE ATTORNEY-GENERAL *v.* WEST HAM CORPORATION.

WHILE not opposed on principle to municipal trading in moderation, we have often felt it necessary to criticise the methods adopted by some of its votaries, and to utter a warning regarding the perils of unsound finance, and of the debasement of such undertakings to the service of political ends, in disregard of the interests of the ratepayers. Such abuses have taken various forms, and have led to much useless litigation and waste of public funds.

Fortunately, however, for those of the ratepayers who have most to lose, the Legislature has retained a certain degree of control over the local authorities. The existence of this controlling power is not often emphasised; and it is only when a group of ratepayers are really hard hit that they summon up sufficient courage to question the authority under which the local Council acts.

The case of The Attorney-General *v.* The West Ham Corporation, which was decided last week by Mr. Justice Neville, affords a good illustration of the fact that the adoption of improper financial methods, even in the alleged interest of municipal trading, will be controlled and condemned by the Court. The essential facts are few and simple. As our readers are aware, the West Ham Corporation some years ago embarked on the supply of electrical energy on an ambitious scale and very advanced lines, and owing to this and other causes into which we need not enter, the Corporation found itself involved in financial difficulty. Borrowing powers being limited in respect of each form of enterprise, some genius conceived the happy idea of lumping all the accounts together, and obtaining an overdraft in respect of them all. It was thought that so long as the entire borrowing powers were not exceeded, it would not matter if the limit was overstepped in one trifling particular—such, for instance, as the electricity account. The figures are startling. On March 31st, 1908, the Corporation's overdraft at the London and County Bank was £90,949 on the electricity capital account and £44,952 12s. on the electricity revenue account. Of these sums, £20,817 7s. 9d. on capital account, and the whole of the £44,952 12s. had respectively been borrowed without the sanction of the Local Government Board. Payments of interest were defrayed out of the fund or rate applicable to the general purposes of the Public Health Act, 1875. These liabilities of the Corporation in respect of electricity dated back to 1905, and it is only fair to say that if the Local Government Board had immediately sanctioned a loan at that time, the situation would have been much relieved. That relief having been withheld, the Corporation eventually obtained an overdraft to the extent of £100,000.

In these circumstances, it is not surprising that some of the ratepayers in the district took a serious view of the

position. The proceedings were set on foot by the India-Rubber and Gutta-Percha Co., one of the largest ratepayers in the district—which, by a strange anomaly of our system of local government, has no voice in its corporate capacity in the selection of persons to serve on the Council. At the relation of the Attorney-General, an action was instituted for a declaration (1) that the overdraft obtained from the bank for general purposes in respect of borrowing powers granted for specific purposes was *ultra vires* and illegal; (2) that the application of money due to the consolidated loans fund in repayment of such overdraft was *ultra vires* and illegal; (3) that the borrowing of money from the bank for the purpose of the electricity accounts otherwise than in the exercise of borrowing powers with the sanction of the Local Government Board was *ultra vires* and illegal. After protracted, and what must have been very expensive, legal proceedings, the plaintiffs have gained a victory.

Mr. Justice Neville has made a declaration in the above terms, and has given judgment for the plaintiffs with costs, but it is in the nature of a Pyrrhic victory, for a substantial proportion of those costs will have to be paid by the plaintiffs as ratepayers. The money will pass from one pocket into another. Fortunately for them, however, the London and County Bank were also parties to the suit. As against them it was alleged that they knew the Corporation were acting *ultra vires*, and therefore they were guilty of a breach of trust. During the trial they came to an arrangement with the plaintiffs, whereby they (the bank) should pay £7,000 to the Corporation in respect of interest upon overdraft, and they also agreed to pay to the plaintiffs the difference between party and party costs which the Corporation might be ordered to pay and indemnity costs.

Mr. Justice Neville expressed his opinion in no uncertain terms: "The Corporation appears to have considered and it certainly acted as though it were entitled to use moneys borrowed under specific powers, not merely for the specific purposes for which the powers were bestowed, but for any purpose to which any funds of the Corporation could lawfully be applied so long as they kept proper accounts of the expenditure. . . . . In my opinion this view of the position of the Corporation was erroneous. I think if they raised moneys under a borrowing power, they were bound to apply the moneys so raised for the specific objects indicated by the statute."

As showing that their electricity venture is largely responsible for the morass of difficulty in which the Corporation of West Ham is plunged, the following passage is material:—"The impropriety of municipal corporations incurring large expenditure on capital account in anticipation of sanction for loans not yet obtained, is well illustrated in the present case, where the Corporation failed to obtain sanction for a loan in respect of an expenditure of over £10,000 on electricity account, with the result that they were driven to make a levy for the amount, in my opinion an illegal levy, inasmuch as the proceeds were applied in payment of liabilities incurred more than six months before the levy of the rate."

What is the moral? He that runs may read. It is that electricity supply is not always conducted on sound lines in the hands of a municipal body; and that even with the rates to fall back upon, and the pecuniary aid which can be obtained from the exercise of legitimate borrowing powers, a financial catastrophe may be the ultimate outcome.

The Electrification of Railways.

We must confess to a little disappointment in the discussion on railway electrification which occurred at the joint meeting of the British and American mechanical engineers.

Excellent of their kind as were the papers submitted, there is no doubt that the radical differences between English and American conditions of working are such as to detract greatly from the interest and practical value of a joint discussion of this kind.

Mr. Westinghouse's paper put in a plea for the selection of a system of traction suitable for universal use; other papers, by Mr. Potter (Schenectady), Mr. Carter (Rugby) and Mr. Hobart (London), compared the merits of the direct-current and single-phase systems of traction to the disadvantage of the latter—Mr. Hobart, in particular, claiming a saving of something like 5d. per train-mile in favour of the direct-current system for suburban working.

However, as Mr. Hobart's data for both the Brighton and the Midland Companies' single-phase lines were disputed by the engineers of those undertakings, it would be premature to accept his conclusions as they stand.

As a matter of fact, practically all the direct-current railways in this country are of a purely local self-contained type and were intended to be such, while the adoption of the single-phase system by the Brighton Co., and for the Midland Co.'s Heysham line, has always been attributed to considerations of a more comprehensive nature.

It is somewhat significant that Mr. Dalziel, of the Midland Co., speaking unofficially, of course, held the opinion that main line electrification is comparatively imminent, and if we correctly interpret his subsequent remarks as to the present limited capacity of certain important sections of the Midland Co.'s system and the costly character of the work of increasing their capacity for steam traction by widening, regrading, &c., the *raison d'être* for the Heysham experiment is not far to seek.

Moreover, it is scarcely likely that the Brighton Co.'s enterprise will be exhausted in South London, and that being so, the advantages or otherwise of direct-current traction for suburban lines appear to be immaterial beside the greater question of choosing a system which will meet the general traffic and constructional requirements of the railway companies.

In this connection Continental opinion appears to be greatly in favour of the single-phase system, and a similar conclusion was reached at the International Railway Congress held within the last few weeks in Switzerland.

While it must be admitted that the alternating-current motor is inherently inferior to the direct-current motor in certain respects, there are countervailing advantages of great moment in its favour, and we incline to the belief that, on the whole, the single-phase system offers the better solution of the problem. All are agreed that electric traction is far superior to steam for suburban service and for congested sections of main railway lines, and in view of what has already been accomplished both at home and abroad, we see no reason why there should be further hesitation on the part of the directors of railway companies owning such systems. More than enough delay has already been incurred while the advocates of rival systems have haggled over their respective merits; let us now "cut the cackle and come to the"—motors!

Telegraphy and Crime.

The recent sensational identification of a fugitive from justice on board ship, communicated to the outer world through the medium of Marconi wireless telegraphy, has had the natural effect of directing popular attention to the capabilities of this agency in a measure not realised even by the repeated instances of the rescue of passengers and crews from sinking ships through the same means. The whole world waited on the wireless messages agog with interest and wonder, and the excitement approached its culminating point as the *Montrose*

neared the land, and it was made known that the suspect was still unconscious of his impending capture. The circumstances irresistibly remind us of a still more momentous episode in the early history of telegraphy—when the public had not yet learned to employ it, and, in fact, there was but one line in existence. We refer, of course, to the famous capture of a man who had murdered a woman, and had left Slough for Paddington by train. The police, following on his track, telegraphed to Paddington, and the murderer was duly arrested on his arrival. That was in 1841, when Cooke and Wheatstone had newly inaugurated telegraphic communication between the railway stations named; and it was from that incident that the public learnt to appreciate the importance of the new invention, which was destined to revolutionise the world's communications.

Now the sensation is repeated, not with one wire, but with no wire at all—yet with the aid of the vast network of cables and wires which distributes the news broadcast. The incident, has served, however, to bring out one significant feature in which the new method lags behind the old—the lack of secrecy. We gather from the *Daily Mail* that wireless messages destined for its columns alone were published in other papers without acknowledgment. This is a grave deficiency, to the removal of which the efforts of inventors should be directed.

Bonus Systems of Payment.

An interesting series of articles by Mr. H. J. Gantt has been running in the *Engineering Magazine*, entitled "Compensation of Workmen and Efficiency of Operation." The term "compensation" here must be taken to mean payment for work done, and not compensation as we commonly understand it in this country. In the May issue Mr. Gantt gives some details of the improvements which he has been able to effect in cotton-mill conditions, and publishes some interesting charts showing the increased output and increased earnings of the operatives due to the bonus system which he adopted. This system, which he calls the "task and bonus system," has been described in previous articles, and except, perhaps, in the matter of detail, bears a close analogy to what in this country is called the "feed and speed" system. In considering the improvements effected, however, we must take into account that the operatives consisted largely of foreign immigrants, and are not to be compared with the average Lancashire cotton operative. A trained observer was set to watch a Pole named Samtack, who was considered to be the best weaver in the room, the observer standing alongside the weaver with a stop watch in his hand, carefully noting in detail all his movements and the time occupied by each. From this it was computed how much the loom ought to turn out, assuming that there was no time lost through the loom being out of order or from any other cause which might be eliminated. Steps were then taken to ensure that the looms were in good order, and that proper filling was always at hand, and a bonus was offered for accomplishing a certain task, which was greater than the best weaver had up to then been able to accomplish.

It is unnecessary here to go further into details of the system, but one remark of the author's is worth careful noting, namely, "There is in every workroom a fashion or habit of work, and the new worker follows that fashion, for it is not respectable not to." The point of this is that when the majority of the workers in a factory are working industriously and earning good bonuses, the new hands very quickly fall into the same habit, or they get very little pleasure from associating with those who are in the fashion.

Another point which the author brings out is that the increase in output in some of the cases cited indicates that the work must have been very inefficiently done before; thus, in one case it is shown that the average increase was about 80 per cent. This is a point which should not be overlooked by those reading such articles, and desiring to institute similar bonus systems in their own factories. Where the operatives are already doing what might be called a fair day's work, it is impossible by any system of bonus or premium to effect such changes as are here indicated, although there is no doubt that there are few cases in which a bonus or premium system will not effect some increase both in the output and in the earnings made on the ordinary time system.

The chief objection to such systems from the trade union worker's point of view is that when once the rate of output has been speeded up, the rate of pay may be cut down so that the earnings may eventually be little, if any, more than they formerly were on the ordinary time system.

So long as good bonuses are, and can be, earned, the following summary of the author holds good:—

"A careful analysis will show that we have established a system of co-operation, where it is to the interest of each bonus worker to do as much work as he can, and to do it as well as possible. Further, if a workman does poor work, others suffer besides himself, with the result that he either learns to do good work or finds work elsewhere. As it is to the interest of the worker to do good work, and plenty of it, he contracts the habit of doing a large amount of good work. As long as it is to his financial interest he will continue to cultivate this habit."

The crux of the whole problem lies in the last sentence, and if there were any guarantee that the rate of pay per piece or job would be maintained regardless of the actual earnings of the individual operative, there is no doubt that bonus and premium systems would be more popular among the working classes than they are. Co-operation or co-partnership appears at present to be the only system by which both employer and employed can be assured of a fair return for their labour and capital, and notwithstanding the recent rejection by the workers of the copartnership principle proposed by Sir Christopher Furniss, there is no doubt that the copartnership idea is gradually gaining ground; and the uniformly satisfactory results that have been obtained hitherto in those workshops where copartnership working has been established, cannot fail to convince those who are still opposed in principle to the idea that it is possible for capital and labour to co-operate to the advantage of both.

What Constitutes Infringement of a Patent?

The case of the British United Shoe Machinery Co. *v.* Simon Collier, which was decided last week in the House of Lords, involved the decision of a point which is interesting to the users of patented machines. The machine in question was for trimming and channelling the soles of boots and shoes. The patent was, in effect, an additional movement to an existing machine, which could be connected up or detached at will. The defendants had purchased a complete machine, but the evidence went to show that they had never used the patented attachment. They had had but few orders for boots which required it to be used, and in cases where they did get such orders they had had the boots made by hand. The patentees sued for infringement. When the case reached the House of Lords, the question of validity was not inquired into, but it was held that, assuming validity, there was no infringement.

The Lord Chancellor, in moving that the appeal should be dismissed, said that there was a denial of the alleged infringement and also a denial of the validity of the patent. The presumption was that the defendants, being in possession of the alleged infringing machines, were guilty of infringement. But it was not established that there had been infringement. It was said that the defendants, without infringing, had kept the articles as a stand-by for future use. There might be such a case, but there was no trace of it in the present instance. The Judges below believed the evidence of the defendants that the latter had put aside the patented portions of the machines, and did not intend to use them. An innocent possessor ought not to be made liable; there must be proof of infringement.

It must be admitted that this decision, having regard to the peculiar facts of the case, accords with good sense; but it undoubtedly opens up a new vista of difficulties for the unfortunate patentee. Must he pry into the workshop of every person known to possess one of his machines in order to see whether it is used or not? Of course, the answer is that, unless a patented machine or a patented process is actually used, no harm is done to the patentee.

THE ELECTRICAL EQUIPMENT OF SMITH'S DOCKS, MIDDLESBROUGH.

The electrical equipment of the shipyard and graving docks of Messrs. Smith's Docks Co., Middlesbrough, presents many features of interest. About two years ago the company, acting on the advice of its consulting engineer, Mr. J. Mitchell Moncrieff, decided to reclaim a portion of the fore-shore of the River Tees, covering some 16 acres of ground, near Middlesbrough. The choice of the site was determined by a scarcity of dry docks on the Tees capable of dealing with the largest ships calling at Middlesbrough, and a plentiful supply of engineering material and labour. The work was carried out by Messrs. John Aird & Co., and includes a shipyard with offices, fitting, machine, wood-working and blacksmith shops, and two dry docks, one 550 ft. long and 67 ft. wide and the other 450 ft. long and 61 ft. wide, both being 26 ft. deep at high water mark of ordinary spring tides.

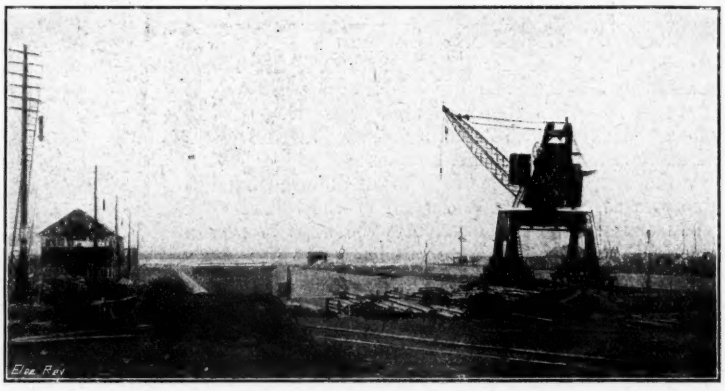

Fig. 1.—View of the Dry Docks, Showing Electrical Jib Crane.

Full advantage has been taken of the electric drive, all the machinery employed being operated, and all the lighting effected, electrically. A general view of the docks is shown in fig. 1, in which can be seen the large travelling jib crane, built by George Russell & Co. This crane has a capacity of 25 tons at 42 ft. radius, 15 tons at 70 ft. radius, and 10 tons at 90 ft. radius. It is fitted with an auxiliary hoisting gear for lifting loads up to 5 tons at a rate of 100 ft. per minute. The lifting speed with a 25-ton load is 20 ft. per minute, and for the lighter loads is proportionately greater. The crane is equipped with four Westinghouse motors of 48, 20, 20 and 15 H.P. for hoisting, derricking, slewing, and travelling respectively, which, with the exception of the travelling motor, are mounted in a cabin on the rotating frame; the travelling motor is mounted on the crane carriage and controlled from the cabin on the rotating frame at such a height as to command a good view. Each of the motors is fitted with an electromagnetic brake, and the hoisting and derricking gears are also equipped with automatic, mechanical and foot or hand brakes. The crane receives its power from a number of plug boxes placed along the track, through a flexible armoured cable.

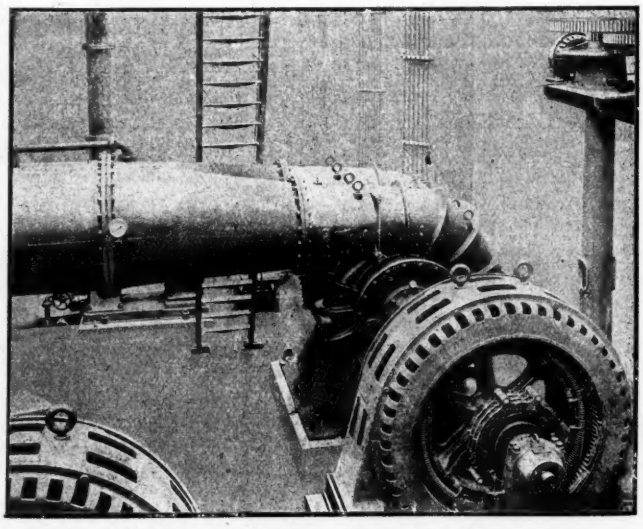

Fig. 2.—Electrical Pumping Plant.

Near the entrance to the docks is an underground pump room, which contains two twin Worthington pumps, with 48 in. diameter suction and delivery pipes, connected direct by flexible couplings to two 400-H.P. Westinghouse slip-ring motors operated by liquid starters. A view of these pumping sets is given in fig. 2. There is also a 12-in. Worthington low-lift pump used for draining purposes; the latter has a capacity of 2,000 gals. per min. against a maximum head of 45 ft. when running at 760 R.P.M., and is direct connected to a 35-H.P. Westinghouse squirrel-cage-motor. A small priming pump is driven through a chain-drive by a 4-H.P. motor. An appliance of this kind is necessary in such an installation, in order to recharge the pumps should they happen to lose their water through the emptying of the dock.

The main pumps are designed for a constant output of 42,000 gallons per minute at a speed of 295 R.P.M., but an official test shows that this figure was exceeded by 10 per cent., the docks being emptied in a correspondingly shorter time. On this test, the maximum pump efficiency was given as 84 per cent., and the load on the motor at this point was only increased by 16 per cent. when working at the lowest head.

The gears for the emptying and discharging valves can be operated either electrically or by hand. A portion of these gears is shown in fig. 3; they are driven by eight 4-H.P. motors, each provided with automatic cut-out gear to prevent any possibility of the valves jamming. The switchboard controlling the various motors receives a 440-volt, three-

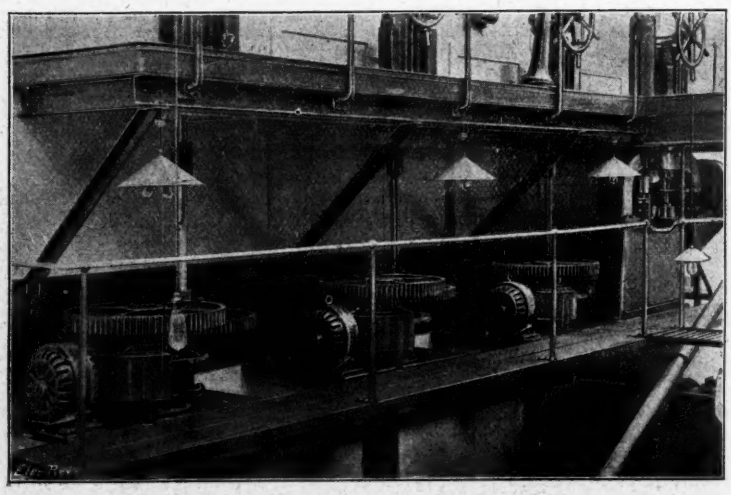

Fig. 3.—Motor-driven Valves for Dock Pumps.

phase supply direct from the sub-station and consists of five marble panels with the necessary switches, fuses and both indicating and integrating instruments. A telegraph gear is provided for the convenience of the docks master in controlling the operation of the pumps. The capstan equipment of the docks consists of five capstans each with a haulage capacity of 5 tons at a speed of 40 ft. per minute and 1¼ tons at a speed of 120 ft. per minute. The capstans are operated by three-phase motors; three are placed at the entrances to the docks and one at the end of each dock.

The shipyard, which is on the Middlesbrough side of the dry docks, is capable of accommodating 18 large steam trawlers at one time. Near the yard is a gut for berthing ships while their machinery is under repair, and immediately in the rear of the yard is a machinery shop, 220 ft. long × 140 ft. broad, containing a mould, lathe and two furnaces, suitable for angle iron 48 ft. long and plates 25 ft. long, heated by two gas producers manufactured by the Gas Power Co.

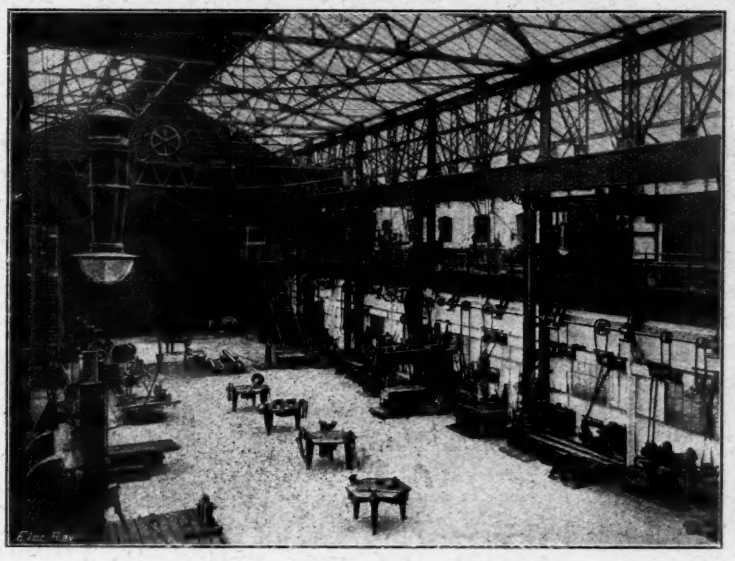

Fig. 4.—The Machine Shop, Smith's Docks.

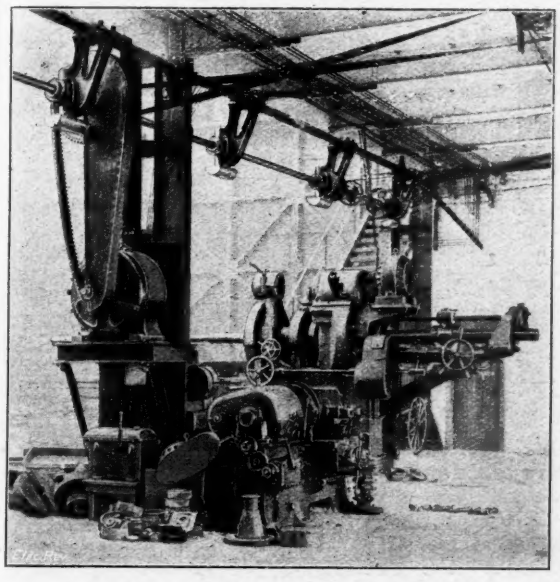

Fig. 5.—Motor Drive for Line Shafting.

geared to a 40-H.P. motor, a plate straightener with rolls 5½ ft. long, driven by a 50-H.P. motor, and a horizontal bending machine, driven by a 20-H.P. motor mounted on the machine. All the motors, both here and in the temporary shed, are protected by wooden casings.

Fig. 4 shows the main aisle in the machinery shop lighted by flame-arc lamps. This aisle is 196 ft. long × 51 ft. wide, with a gallery 25 ft. wide on each side.

The illustration shows a 30-ton crane electrically operated, which travels the whole length of the building.

The two lines of shafting are each driven by two 30-H.P. motors through short lengths of chain drives, but, by disconnecting the coupling joining the two halves of the line shaft, each half can be driven by one motor. There are also two large shafting lathes, each 30 ft. long, driven from the main shafting; a large horizontal boring machine driven by a 10-H.P. motor, and a medium-sized vertical boring machine driven by a 5/20-H.P. squirrel-cage motor, the speed variation being obtained by special motor winding connections.

A sub-station in a corner of the shop contains two 60-KW. motor-generator sets supplying direct current for lighting the docks and works, and two distributing switchboards; one with eight panels for alternating current, controls the air compressor motor, capstans, fitting shop and the motors of the motor-generator sets; the other five panel direct-current board, controls the generators and lighting circuits.

A set of rolls, 15 in. in diameter × 30 ft. long, in this shop is driven by a 75-H.P. Westinghouse slip-ring motor operated by a liquid controller for rolling, and a 25-H.P. Westinghouse squirrel-cage motor for lifting the rolls. The joiners' and blacksmiths' shops, the former covering an area of 130 ft. × 70 ft., and the latter 111 ft. × 70 ft., will, when fully equipped, contain 30 fires, a large ground fire, a Roots blower driven by a 15-H.P. A.C. motor and a 5-cwt. Massey power hammer driven by a 20-H.P. A.C. motor, which are at present in a temporary shed near the fitting and machine shops. All the machines in this temporary shed are individually driven, and among them are a 30-ft. plate-edge planing machine, and a large roll, 2 ft. diameter × 17½ ft. long, each driven by a 20-H.P. motor, while outside are a punch and shears driven by a 20-H.P. motor mounted on the top of the machine; a joggling machine,

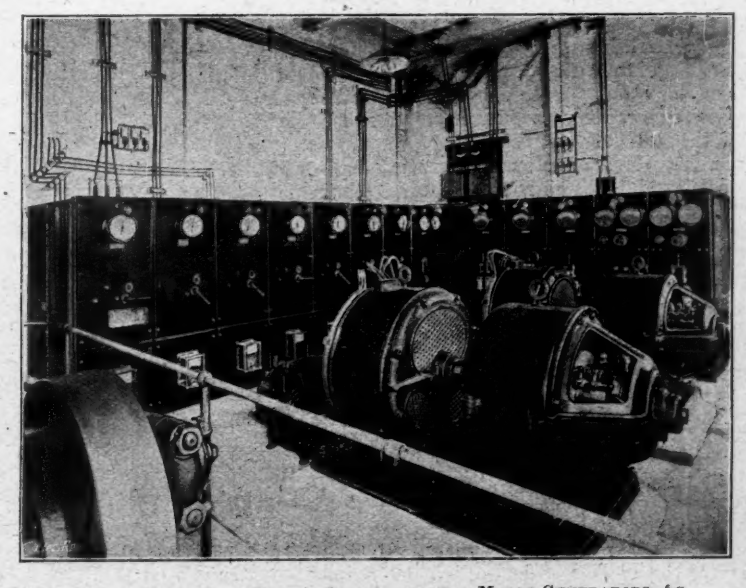

Fig. 6.—Sub-station, Smith's Docks, showing Motor-Generators, &c.

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The main alternating-current panel contains an automatic oil switch and an ammeter and voltmeter, whilst the other alternating-current panels each contain an oil switch, ammeter, and an integrating wattmeter; the direct-current panels each contain a two-pole switch, porcelain-handle fuses, and ammeter, whilst the generator panels are also provided with voltmeters and voltmeter plugs. All circuits which lead from the station to the outside circuits are protected with choking coils and lightning arresters, which may be seen by reference to fig. 6. A 22-K.V.A. 440/220-volt single oil-insulated self-cooled transformer is installed in the station for supplying the lighting when the direct-current sets are not running, and also a compressor for furnishing air at 100 lb. pressure to the pneumatic tools. This machine, driven from a 120-H.P. slip-ring motor on the gallery above, is operated by an automatic liquid starter controlled by the variation of air pressure in the air receiver. Power is fed to this station at 440 volts from the main sub-station situated near this shop, at which three-phase power at 3,000 volts received from the Cleveland and Durham Electric Supply Co. is transformed down by a 500-K.V.A. oil-insulated self-cooled transformer. From this sub-station circuits are also run direct to the pump-house, dock crane, and ship-yard.

The whole of the electrical installation has been completed under the supervision of Mr. C. W. Fairweather, consulting electrical engineer to Smith's Docks Co., and the wiring was carried out by Messrs. Warren, Beattie & Co., of Middlesbrough.

With the exception of the capstans, the whole of the electrical apparatus for the above installation was supplied by the British Westinghouse Electric and Manufacturing Co., Ltd.

THE HOPKINSON TEST APPLIED TO INDUCTION MOTORS.

By GEORGE H. FLETCHER.

The following description of a method of testing induction motors of comparatively large sizes is one not generally known, and was utilised by the writer to meet a special case, in which it was impossible to load the motors either by connecting them to a direct-current generator or with a mechanical brake.

The machines in question, of 120 H.P., at 1,050 volts, 900 R.P.M., were intended to drive pumps of the vertical type used in pit-sinking operations, and were themselves designed to work in a vertical position, the weight of the rotor being supported by a ball bearing at the top of the motor, and the lower bearing being simply a guide to keep the shaft central.

For testing purposes the two motors were coupled rigidly together, one above the other, both rotors being joined by a sleeve coupling. The method employed was a modification of the well-known Hopkinson test, the top motor being run as a motor and the bottom as a generator. Both stators were connected in parallel, and, of course, had the same direction of rotation.

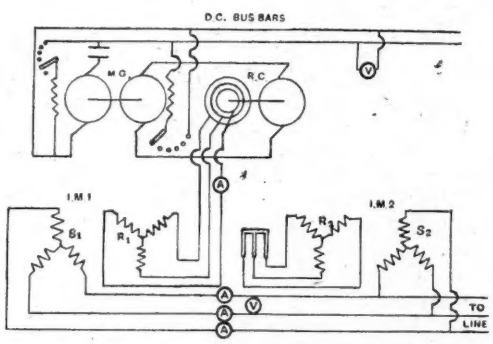
When the two are up to speed the rotor of the motor is short-circuited, while that of the generator is connected to the slip-rings of a rotary converter (R C in drawing). The rotary must be supplied from a low-voltage circuit—50 volts or less—current being obtained from a motor-generator set. If, when both motors are running at full speed, current be switched on to the direct-current side of the rotary converter (the field of which is unexcited), the rotor R_1 will then become excited with a direct current, and an E.M.F. will be generated in stator S_1, which will be of the same frequency as that of the supply.

If, now, the excitation of the rotor R_1 be increased, the E.M.F. of stator S_1 will tend to become higher than that of S_2, and accordingly a circulating current will commence to flow between the two machines. This will, of course, have the effect of loading up the motor, and consequently the speed will drop somewhat below synchronous speed owing to the slip. The current generated in the stator S_1 would now, therefore, be of less frequency than that of the supply, and the two machines would fall out of step. If, however, the field of the rotary converter be excited, the machine will commence to revolve, and the direct-current excitation of the rotor R will be changed into an alternating current of low frequency, which will have a value corresponding to that of the motor slip. No very fine adjustment of the field is necessary to obtain the right speed for the rotary, as the E.M.F. generated in the rotor of that induction-motor, which is run as a generator, will fall into step with that of the rotary, and the two will run synchronously. A correct value of field current can easily be found which will give the steadiest running.

The load is regulated by increasing or diminishing the D.C. supply voltage to the rotary; an increase in the volts will increase the stator volts generated, and, consequently, the circulating current. At the same time, it will cause the speed of the rotary to increase slightly, and will thus make up for the increased slip.

In the case of the motors referred to, the slip corresponding to full load was 2·3 per cent., and the frequency of the supply was 60 cycles. If the rotor of the generator was supplied with direct current, the generated E.M.F. would have a frequency of 58·62 cycles.

In order to make this synchronise with the supply, the



M G, Test motor-generator; R C, Rotary converter; I M, Induction motors; S, Starters; R, Rotors.

Diagram of Connections.

rotor must be excited with alternating current at 1·38 cycles. The rotary being of the four-pole type, the speed of this would be 41½ R.P.M.

The above method is not only useful for a temperature test, but may also be used to obtain the characteristic curves, *i.e.*, power factor, efficiency, slip, torque, &c.

Wattmeters are connected in the motor circuit of the set, and the rotor of this motor, instead of being directly short-circuited, is shorted through ammeters of sufficient capacity to measure the full-load rotor current.

The resistances of stator and rotor having been taken, and a light load reading (core loss and friction) on one machine having been obtained, the efficiency is equal to—

$$\frac{(W_1 + W_2) - [W_L + 3\,(C_S^2\,R_S + C_R^2\,R_R)]}{W_1 + W_2},$$ where

W_1 and W_2 = wattmeter readings on load,
W_L = light-load reading,
C_S and C_R = stator and rotor currents,
R_S ,, R_R = stator and rotor resistances.

The power factor, of course, will be found in the usual way—

$$\frac{W_1 + W_2}{\sqrt{3} \times E\,C_S}.$$

The slip can be measured by counting the oscillations of the ammeter in the rotor circuit, and may be expressed—

$$\text{Percentage slip} = \frac{N}{2} \times \frac{100}{60\,n} = \frac{N}{1{\cdot}2\,n}.$$

$\frac{N}{2}$ = half the number of oscillations per minute, two

oscillations being equivalent to one cycle; n = frequency of supply.

Another method of determining the efficiency is as follows:—Connect wattmeters in the motor and also in the generator circuits of the set. The three phases should be equally balanced, and in this case one wattmeter in each case will suffice. If there were no input from the rotary the efficiency would simply be $\frac{W_o}{W_1}$, where W_o is watts output and W_1 is watts input. However, there is also W_3 input from the rotary, where $W_3 = \eta E_R C_R$ (E_R and C_R being the D.C. voltage and current to the rotary); η is the efficiency of the machine, which, being a test machine, has been experimentally obtained.

The combined efficiency of the motors is now—

$$\frac{W_0}{W_1 + W_3}.$$

This method has been found entirely successful, and the operation presents no practical difficulties, since all the machines used are generally to be found on any electrical testing bed.

ELECTRIC COOKING APPARATUS.

By M. FARRER.

The following are a few suggestions and rough notes on the results of some practical tests recently carried out on a few of the most practical cooking appliances now on the market.

One thing which strikes one forcibly when trying to bring the various implements into actual household use, is the apparent want of common sense with which some of the designers seem to be afflicted. For instance, one fast-boiling kettle is so designed that as soon as it begins to boil, water is blown violently out of the spout, soaking anything in its immediate vicinity before one can run to the switch. This same kettle is so designed that it scorches anything it is stood on. A small beading round the rim, to raise the heating element slightly above the surface the kettle is stood on, seems so obvious and simple a precaution that it amazes one that it should not have been carried out.

Again, how long shall we have to wait for standardised terminals? Why should three or four utensils, all taking about 1,000 watts, have terminals of varying size, so that the table has to be littered with several lengths of flexible, each with its special terminals and plug top?

For a long time yet the average household will use these implements attached to an ordinary lamp-holder and plug controlled by a 5-ampere switch. Of course, no ordinary 5-ampere switch will break 5 amperes more than a few times without the risk of speedy destruction of the switch, therefore it seems advisable that every utensil should be fitted with a substantial switch of ample carrying capacity. Breaking the circuit by pulling the sockets off the terminals is a very crude method, but the only safe one under existing conditions, although liable to result in burnt fingers.

Each appliance ought to be sent out complete with a length of flexible of ample carrying capacity, and covered with fireproof material. The ordinary servant is sure, sooner or later, to leave the flexible lying on the top of a hot plate which has just been switched off, to the ruination of ordinary flexible. The practice of the B.T.-H. Co. is to be commended in this respect. Their irons are sent out complete with suitable flexible, and only require a plug top fitted. It is a pity more makers do not follow their example.

Heat regulation is another matter entirely ignored by a large number of makers; 1,000 watts is, no doubt, necessary for rapidly bringing water to the boil, or for heating up a hot plate. Once these points are reached, such a consumption is absurdly wasteful.

All the above points, although small in themselves, tell against electricity when we are trying to compete against the well-known convenience of a gas stove.

We cannot, at any rate at present, compete against gas as regards cost alone; therefore, the only way to make electrical cooking popular is to make it, as it can be made, far more convenient and cleanly than gas cooking.

One appliance that the writer has in use is the Phœnix grill. This is an excellent article, and will do any ordinary frying or grilling, as well as or better than a gas stove, and with equal speed. It is excellent for toasting, and is altogether a most practical article. It would be improved by a controlling switch, as already suggested. The plug tops soon get too hot to touch.

Another useful appliance is the Wilkinson stove. One of the early patterns was tried, but did not prove very successful. It was made for 700 watts, which did not give sufficient heat. It seemed more useful as a radiator than as a cooking stove.

Recently the new 1,000-watt stove has been put into use, and excellent results have been obtained from it. It is used in conjunction with a three-tier steam cooker 9 in. in diameter, which exactly fits the top of the stove. Cost of the cooker, 5s. 6d.

This makes a most useful combination, and is economical in use, as several things can be cooking simultaneously. For instance, fish, two vegetables or more, a suet pudding, and meat can all be cooking together.

With the Wilkinson cooker it is most important that the top of the stove should be completely covered with whatever cooking utensil is in use, as, otherwise, so much heat is radiated away. When the stove is only partially covered, the heating coil remains at a medium red heat, whilst when covered it becomes almost white.

A word of caution is necessary with reference to this stove when it is thus completely covered. The whole body becomes extremely hot, and unless it is stood on a stout metal tray it will burn anything under it. After prolonged use the terminal plugs, although of substantial size, are much too hot to touch. Here, again, a switch should be fitted.

Neither of the above apparatus is suitable for boiling water. The Phœnix grill took 18 minutes to boil $1\frac{3}{4}$ pints in an aluminium kettle with a consumption of ·3 unit; the Wilkinson stove boils the same in 14 minutes, and three pints in a patent "Kwik" kettle in 23 minutes.

The G.E.C. oven has been in constant use for over a year. The actual oven is a great success, and has not been touched, but considerable trouble has been experienced with the two hotplates on top, and these cannot be termed satisfactory, due to the fact that they are not sufficiently protected from any water, &c., that may boil over, and they consequently break down to earth after about three months' use.

With regard to the working and consumption of the oven, it is necessary to have the current on full—*i.e.*, 1,000 watts—for a quarter of an hour before starting to cook, but after half an hour's cooking it can be reduced to 700 watts. The oven is switched off half an hour before cooking operations are completed. The consumption works out for a 5-lb. joint and pastry between $1\frac{1}{2}$ and 2 units.

The house in which this oven is fitted contains neither kitchen range nor gas cooker. The whole of the cooking for the household has been done electrically for over a year.

Since writing the above, the writer's attention has been drawn to the "Tricity" cookers. An opportunity has not yet occurred for testing any of these, but he is informed that many of the objections raised in this article to small details have been overcome in these cookers.

Amble (Northumberland) Lighting.—At a meeting of the Urban Council on the 22nd ult., a letter was read from Mr. Swarbrick, of Leigh, stating that he was prepared to establish an electrical supply undertaking (without a Parliamentary order) for public and private lighting in the district. He proposed that, in the event of the Council supporting his scheme and entering into an agreement, he should be granted the option of transferring his right to a company. A tender from the local gas company for one year was accepted, and it was decided to seek further details as to Mr. Swarbrick's scheme.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Obsolescence and Exhaust Steam Turbines.

I venture to think the remarks contained in your article of July 15th on the above subject are not justified, and would be glad of the opportunity of making the following comments.

It is true that the opinion was expressed by Mr. Ferranti and some other speakers at the recent meeting of the M.E.A. that the installation of exhaust steam turbines for working in conjunction with existing reciprocating engines was only a temporary expedient, and that in many cases it would probably be best to scrap existing reciprocating engines and buy new high-pressure turbines instead of sinking further capital for the purpose of patching up old reciprocating engine plants.

The fact cannot be overlooked, however, that the combination of reciprocating engine and exhaust steam turbine is regarded as an extremely economical one, to such an extent, indeed, that at the present time, in one or two isolated cases, *new* engines are being installed for working in conjunction with exhaust turbines. Whilst there is a good deal to be said against this system, as compared with the plain high-pressure turbine, the fact that in one or two cases the extra capital expenditure is actually being incurred illustrates the fact that under certain circumstances the suggestion is practicable.

It follows that if the system is practicable where new plant is being installed, for cases where reciprocating engines already exist the addition of an exhaust steam turbine must be doubly justified.

It should be remembered that in the case of a mixed pressure turbine installed primarily for working with exhaust steam, the economy when working partly with high-pressure steam is better than the economy which would be obtained in the ordinary way by installing a turbine designed solely for dealing with high-pressure steam. This is, of course, due to the size of the low-pressure portion of a mixed pressure turbine, giving more economical results when working with high-pressure steam than the smaller low-pressure proportions of a high-pressure machine would do.

And this brings me to the further point raised by Mr. Ferranti—namely, if first cost was not the primary consideration on the part of purchasers, manufacturers would be able to build a design of turbine, which, whilst somewhat more expensive in first cost, would be more efficient in working than the plant which they are, generally speaking, at present installing.

E. J. Fox.

Rugby, *July 26th*, 1910.

[No doubt many engineers will be found to justify the adoption of exhaust steam turbines, because they have reciprocating plant in use. It does not follow, however, and Mr. Fox does not suggest, or supply data showing, that this course is likely to lead to the lowest generating cost, inclusive of capital charges. Needless to add, we do not question the *practicability* of the arrangement.—EDS. E.R.]

Contracting Manufacturers.

I was rather surprised a few days ago to receive an application for plans and specification of an advertised electric wiring job—of some 500 lights—for which I am acting as consulting engineer, from the representative of a firm of cable makers belonging to the Cable-Makers' Association. I felt a little as though I had chanced upon a beer lord officiating at the beer-engine of "The Pig and Whistle" or a bishop eking out his income by a turn at pew opening.

Joking apart, I think such competition is not fair. I have specified C.M.A. cables, as most consulting engineers do, in first-class work, knowing that my clients would pay an extra price for quality and British production, guaranteed by the whole Cable-Makers' Association. It never entered into my conception of things possible that a company—members of this Association—would compete with the ordinary contractor, with the treble handicap in its favour of the manufacturer's profit, the bounty profit, and the profit of the custom of contractor customer with whom it was not for the moment competing.

If I had the time available it would not be difficult to show that this move is not in the interests of the C.M. Association, of the contractors, of the consulting engineers, of the industry, or, in the long run, of the firm concerned.

Perhaps some of your readers would express their opinions; public opinion is the very best form of moral suasion, because behind it there is always the menace of "the big stick."

Thomas Tomlinson.

Dublin, *July 27th*, 1910.

Incandescent Lamp Sales in the United Kingdom.

With reference to statements made in the daily papers, it would be interesting to know how the totals of lamp supplies are made up. I had occasion about 12 months ago to collect such data, and my totals were :—

	Lamps sold per annum.
Public supply mains	19,740,424
Private plants	2,500,000
Total	22,240,424

I shall look forward to those readers who have prepared similar statistics, publishing the same in your columns. My figures were calculated by taking the totals from (1) consumers on supply mains; (2) lamps used for street lighting; and (3) lamps in use on railways, factories, private houses, warehouses, &c., and striking an average number of burning hours per annum for each section.

Cyril A. Greig.

London, N., *July 27th*, 1910.

The Proposed Association of Consulting Engineers.

Referring to your article on this subject in your issue for the 22nd inst., may I point out that civil engineering comprises every branch of engineering except military engineering. In fact, the word "civil" in this connection was originally introduced about the end of the eighteenth century to differentiate the new kind of engineering that was then springing up from the older military engineering, which, up to that date, was the only engineering recognised as such.

Furthermore, the Charter of the Institution of Civil Engineers, of the year 1828, defines the profession of a civil engineer as "being the art of directing the great sources of power in Nature for the use and convenience of man."

In considering the constitution of the proposed Association of Consulting Engineers, it will be well to bear the above points in mind.

M.Inst.C.E., M.I.E.E.

Westminster, *July 29th*, 1910.

Commutator Troubles.

The trouble mentioned by "Also Worried" is obviously due to the dynamo having too little reserve voltage. An accumulator when first put on charge has a charging voltage of about 2·15, but by the time the charge is completed the voltage has risen to 2·65. That is to say, in order that the normal charging rate may be maintained throughout the charge, the machine must have an initial voltage not greater than 78 per cent. of its possible maximum.

It is very improbable that the last four stops of the shunt regulator in the case mentioned by "Also Worried" represent 22 per cent. of the total voltage of the machine, and I am inclined to doubt that the machine ever maintained its full charging current throughout the charge.

Why does Mr. Hilder represent the charging voltage curve by a straight line?

H. W. Underhill.

East Ham, *August 1st*, 1910.

HYDROELECTRIC POWER.—The address was omitted from Mr. W. J. Fenton's letter. On receiving it we shall be pleased to reply.—EDS. E.R.

BRUSSELS EXHIBITION.

(Continued from page 116.)

Messrs. Crossley Bros., Ltd., of Openshaw, have an exceptionally good show of gas engines and plant. The engines are supplied with gas from their new type suction gas plant, using bituminous coal, which, it is claimed, completely cleans the gas with their patent tar extractor, and is fitted with an automatic water feed to the vaporiser controlled by the load on the engine. The coal consumed is guaranteed not to exceed 1 lb. per B.H.P.-hour at full load.

The most important exhibit was a four-cylinder vertical gas engine, developing 110 B.H.P. on producer gas at 250 R.P.M. (fig. 13). This engine is provided with forced lubrication to all parts, and high-tension electric ignition. A powerful spring-loaded governor controls the amount of gas and air passing into the cylinders, and a hand regulating gear is provided by means of which the speed can be varied 10 per cent. above or below the normal. The mixing of the gas and air does not take place until these gases enter the inlet valve of each cylinder, thus obviating the possibility of back explosions in the supply pipe, and limiting the effect of a back explosion to the cylinder in which it takes place.

The cylinder head containing the inlet and exhaust valves has ground joints and is water cooled. The valve gear is extremely simple and strong. Any cylinder can be put out of operation when desired by closing the gas cock with which each cylinder is provided, without interfering with the working of the engine. The exhaust valve main connecting up the cylinders is water jacketed, thus keeping down the temperature of the engine room. Starting is effected by means of compressed air, each cylinder being fitted with automatic admission gear.

The firm are showing here for the first time their new type horizontal gas engine. The prominent feature of the design is its great simplicity, and the absence of all superfluous and complicated parts.

The engine bed is extended to the back end of the cylinder, which is, therefore, supported for its whole length. The valves are arranged vertically in the breech end, the inlet valve being placed immediately above the exhaust valve. A separate gas valve is mounted on the inlet valve spindle. The valves are operated mechanically by means of hardened steel cams.

Governing is effected by varying the lift of the inlet valve, by means of patent variable admission governor gear, which has only two essential parts—namely, a movable fulcrum and a radius lever.

The speed variation is from 1½ to 2 per cent. above or below

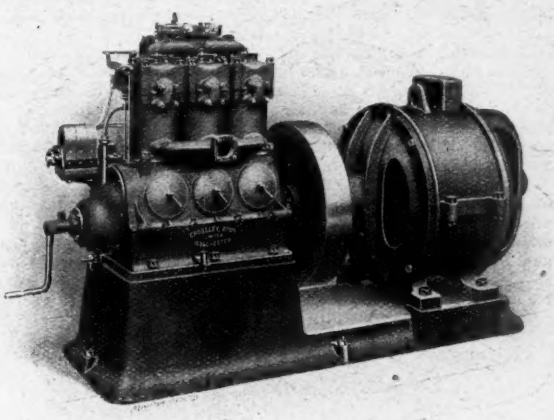


Fig. 15.—Crossley Vertical Three-Cylinder Gas-Dynamo.

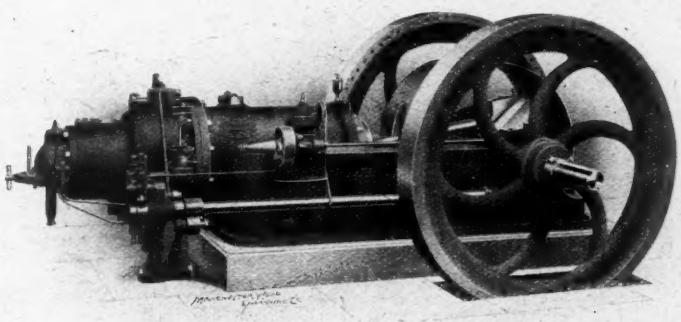


Fig. 14.—Lampless Crude-Oil 40-B.H.P. Engine.

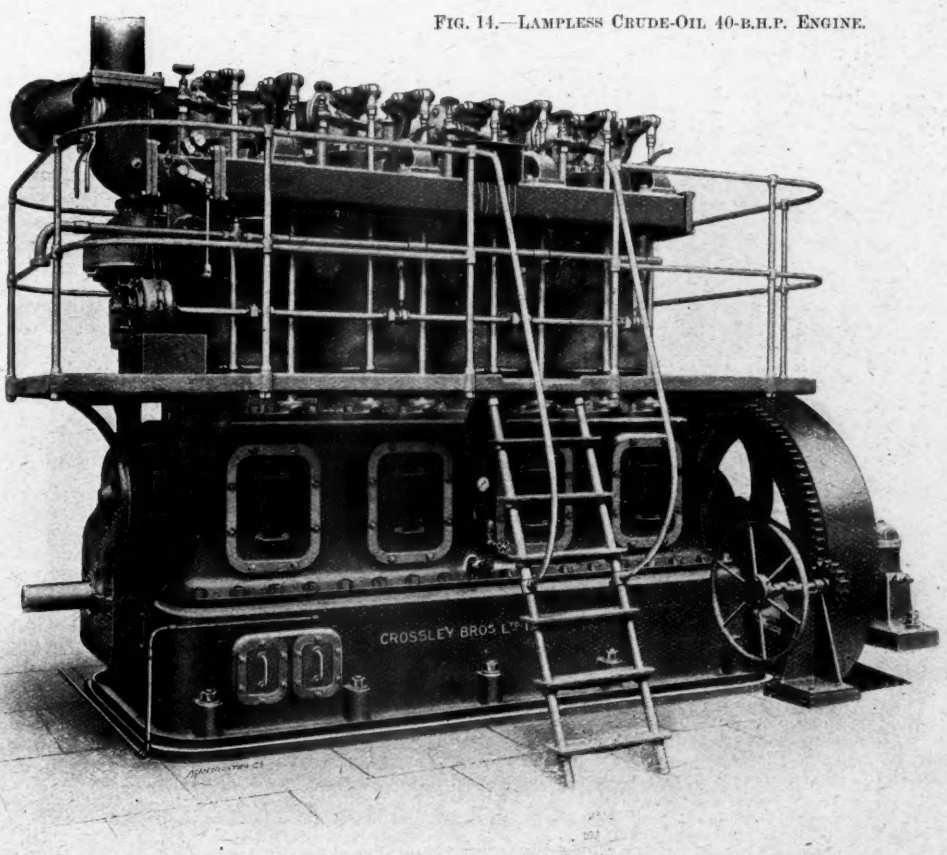


Fig. 13.—Crossley Four-Cylinder Vertical 110-B.H.P Gas Engine.

normal from full to no load. Ignition is effected by a low-tension magneto operated from an eccentric pin on the sideshaft. Automatic lubrication is provided. The engine gives 65 B.H.P. on producer gas, and is capable of carrying 10 per cent. overload. Its appearance closely resembles that of the crude-oil engine which is also exhibited, and which we illustrate in fig. 14, p. 209.

Other exhibits include a single-cylinder horizontal gas engine of 175 B.H.P., with engine bed of the girder type, specially designed for export; a marine oil engine for heavy duty, with propeller; two horizontal benzine engines; a vertical petrol engine, and a small vertical gas engine and dynamo. The last is illustrated on p. 209; it has an output of 7 KW. at 750 R.P.M., and is similar in construction to the large vertical engine.

Messrs. Marryat & Place, of London, whose stand was one of the very few that were completely finished on the opening day, are showing a 10-cwt. passenger lift gear with push-button controller, arranged to operate a model four-floor passenger elevator, and a car-switch and rope-operated lift controller. We illustrate the former herewith, showing the worm gear and magnetic brake. In the push-button controller, the number of parts has been reduced

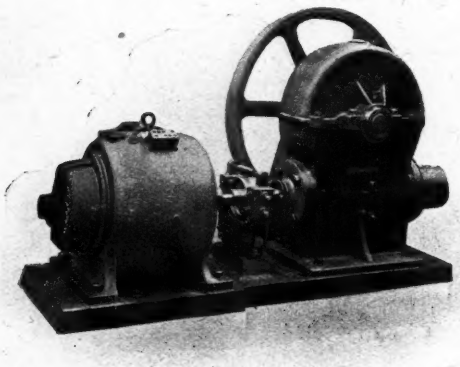


Fig. 16.—Marryat & Place Lift Gear.

to a minimum, and the controlling panel and selecting switch are placed in the motor house, all contacts having been removed from the lift well. The connections are interlocked with the doors so that the cage cannot be moved while a door is open, and besides a push-button board in the car, there is a special stop button which enables any mistake in starting the car to be rectified by the passenger.

The Morgan Crucible Co., Ltd., of Battersea, have a stand in the British Industrial Section, on which a great variety of their Morganite brushes is shown; these are made in layers so that the conductivity in the radial direction is very high, while the resistance in the peripheral direction is seven or eight times as great as the longitudinal resistance, facilitating the collection of the current while greatly assisting sparkless commutation. The plumbago of which the brushes are made is not subjected to a high temperature in the course of manufacture, and consequently the coefficient of friction is very low; the metal tops and flexibles can also be

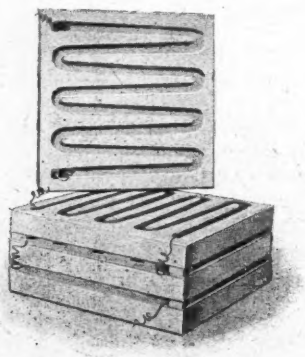


Fig. 17.—"Battersea" Lightning Arrester Resistances.

embedded in the brushes in the process of manufacture, ensuring a perfect electrical connection, without the use of solder. The "Battersea" carbon brushes are also shown, in which a special method is used for fixing the flexibles in position with a metallic powder compressed into a socket, and the "Battersea" lightning arrester resistances, of which we give an illustration (fig. 17). The latter consists of a slab of insulating and fireproof material, in the surface of which a groove is made, which is filled with a special grade of carbon resistance powder; the terminals consist of carbon blocks with copper flexibles embedded in them. These resistances remain constant after repeated discharges, do not burn out or short-circuit, are indestructible by heat, and are very compact; they are suitable for over-pressure discharge apparatus, or any other case where a high resistance capable of absorbing a large amount of energy for a short period is required. With 6,000 volts applied to a standard slab for seven minutes, the current rose to a maximum of 1·9 amperes, and fell gradually to 1·35 amperes.

(*To be continued.*)

LEGAL.

Electrical Competition.

In the Chancery Division Mr. Justice Joyce had before him a petition by the Hendon Paper Works Co., Ltd., asking for the sanction of the Court to an extension of their powers so as to include, amongst other things, the generation of electric power for the purpose of lighting and heating their works at Sunderland.

Mr. Younger, K.C., appeared in support of the petition, which was opposed by Mr. Gore Browne, K.C., on behalf of the Town Council of Sunderland, on the ground that by their provisional order of 1891 they had the sole right of supplying electricity within their borough. They contended that the extension of the company's powers as proposed would enable them to finance and run an electric lighting company, and would thereby depreciate the Corporation's undertaking.

Mr. Justice Joyce thought that there was nothing in the Corporation's provisional order which prohibited the company having the powers they asked for, and he accordingly sanctioned the extension as proposed.

Clarke *v.* The Consolidated Electric Power and Appliances, Ltd.

The plaintiff in this action, on Friday, moved for the appointment of a receiver of the defendant company.

Mr. Beddall, in support of the motion, said he was the holder of £2,500 debentures, which was the whole of the issue. The company was formed for carrying out contracts under Government, and was very successful. It had, however, borrowed money, which had been suddenly called in, and there was a fear of a judgment and execution. The plaintiff accordingly moved for a receiver, on the ground that the assets were in jeopardy.

The company did not oppose, and there being the necessary affidavits of fitness, Mr. Justice Parker appointed Mr. J. W. Harling.

Attorney-General *v.* Corporation of West Ham.

Mr. Justice Neville delivered judgment in this case on Friday last, as follows:—

In this case the Attorney-General sues the Corporation of West Ham, to put an end to alleged illegality on the part of the Corporation in the conduct of the business entrusted to them by the Legislature—the statutory powers of the Corporation include the supply of electricity and of electrical fittings. For these and other purposes they have been entrusted with extensive powers of borrowing, in some instances (including their electrical undertaking) to be exercised with the sanction of the Local Government Board. The Corporation had 10 different accounts at their bankers, into one of which, the general account, they paid all receipts on account of the borough fund and the general district rate, and upon which they drew in respect, amongst other things, of their expenditure upon their electrical undertakings. The Corporation kept in their books two electricity accounts, one called the capital account, dealing with expenditure on fixed capital, and the other the revenue account, which, besides showing the surplus or deficiency on the year's working, included their expenditure on electrical fittings and stores. For the latter they had borrowing powers to be exercised with the sanction of the Local Government Board, but they had not on March 31st, 1908, obtained any such sanction. Any deficiency upon the year's working was estimated for in the rate for the following six months and levied; but no estimate was made in respect of the capital expenditure upon the electrical undertaking, whether fixed or floating. This was found either from other funds of the Corporation not properly applicable for that purpose, or by an overdraft from the bank. On March 31st, 1908, the overdraft on the electricity revenue account was over £44,000, and on the capital account over £92,000. In my opinion these overdrafts were illegal. On April 15th sanction was obtained from the Local Government Board for a loan on electricity capital account of some £64,000. Towards the end of 1905, by this and other expenditure made for legitimate purposes, but which was intended to be met out of funds to be produced by the exercise of their borrowing powers, and for which, consequently, no estimate was made or rate levied, the Corporation had got themselves into considerable financial difficulties, and were unable, without financial assistance, to provide for their current expenditure. They had at this time unexhausted borrowing powers which (upon the sanction of the Local Government Board being obtained), would, if exercised, have to some extent enabled them to recoup their expenditure upon capital account, and in December, 1905, they applied for sanction to borrow moneys in respect of certain works. It is only fair to the Corporation to say that the sanction which was ultimately given in respect of the greater part

of their application was not so given until April 18th, 1908, and this delay undoubtedly added to their embarrassment, and tended to prolong the period during which they sought assistance. In this state of affairs the Corporation in November, 1905, applied for an overdraft to the defendant bank (the London and County Bank), and after some negotiation an overdraft was granted to them to the extent of £120,000, subsequently increased to £200,000; from the time when the overdraft was granted until shortly before the commencement of the action, the accounts were almost continuously overdrawn. At the time the Corporation obtained the overdraft they had unexhausted borrowing powers, and I will assume that these were in excess of the overdraft, though the evidence is somewhat meagre on the point. The Corporation appear to have considered, and they certainly acted, as though they were entitled to use moneys borrowed under specific powers, not merely for the specific purposes for which the powers were bestowed, but for any purpose to which any funds of the Corporation could lawfully be applied, so long as they kept proper accounts of the expenditure. I think the correspondence and applications to the bank show that they intended so to apply the bank's advances from the first, and, in fact, the overdraft was allowed on all the accounts, and a general balance struck daily upon them all. In my opinion this view of the position of the Corporation was erroneous. I think that if they raised moneys under a borrowing power, they were bound to apply the moneys so raised for the specific objects indicated by the statute. I think that upon this ground the obtaining of the overdraft was *ultra vires* of the Corporation. Whether an overdraft extended over several years for substantially the whole amount of the authorised loan could be justified as a temporary loan within the meaning of the decision, I need not decide; but, in my opinion, the question is at least doubtful. Upon the point whether, having regard to the statutory provisions under which corporations are enabled to procure the funds to discharge their liabilities, they are entitled to borrow money by way of overdraft for general expenditure, at all events, except under special circumstances, I also reserve my decision. The impropriety of municipal Corporations incurring a large expenditure on capital account in anticipation of sanction for loans not yet obtained is well illustrated in the present case, where the Corporation failed to obtain the sanction for a loan in respect of an expenditure of over £10,000 on electricity account, with the result that they were driven to make a levy for the amount, in my opinion an illegal levy, inasmuch as the proceeds were applied in payment of liabilities incurred more than six months before the levy of the rate. The bank having agreed terms with the plaintiff, I refrain from discussing what, upon the evidence, their position would have been in respect of their advances. On March 31st, 1908, the general account of the Corporation with the bank was largely overdrawn to the extent of some £38,000, after deducting the amount due to the consolidated loan fund, but which had, from time to time, been paid into the account in reduction of the overdraft in accordance with an arrangement with the bank. In my opinion the application of the amounts due to the consolidated loan funds in reduction of the overdraft was illegal. At the trial application was made for leave to plead the Public Authorities Protection Act, 1893, and the Trustee Relief Act, 1888. In the course of the trial I gave such leave, subject to all questions of costs and adjournment, and the matter proceeded upon that footing. Counsel for the Attorney-General having refrained from asking for relief against the defendant Patterson personally, the Trustee Relief Act can have no application. The question of the applicability of the Public Authorities Protection Act, 1893, was not fully argued. In my opinion, however, it would apply in favour of the Corporation and the borough treasurer in respect of acts completed more than six months before action. The overdraft, however, from the bank and the repayments out of the moneys due to the consolidated loans fund continued up to a period within six months before the commencement of the action, and I think the plaintiff is entitled to declaration in respect of such continuing illegality, although the plaintiff is not entitled to all the relief claimed. I think that, having regard to the time at which the application to amend was made, this should make no difference as to the incidence of the costs of the action. I propose to declare: (1) That the overdraft obtained from the bank for general purposes in respect of borrowing powers granted for specific purposes was *ultra vires* and illegal; (2) that the application of money to the consolidated loans fund in payment of such overdraft was *ultra vires* and illegal; (3) that the borrowing of money from the bank for the purpose of the electricity account, otherwise than in the exercise of borrowing powers with the sanction of the Local Government Board, was *ultra vires* and illegal. The defendant Corporation and the defendant Patterson must pay the costs of the action.

Mr. Danckwerts (for the Corporation) said that if the Corporation got the sanction of the Local Government Board it would put them straight, and they would be able to proceed. He wanted an expression of opinion from his Lordship that there was nothing to prevent the Local Government Board, if they thought fit, from giving that sanction.

His Lordship refused to do that.

Mr. Danckwerts asked his Lordship for time, so that the Corporation could put themselves straight. He suggested until March 31st, so that they should not be presumed to intentionally break the declarations that his Lordship had made, as some proceedings might be taken on the other side to enforce the judgment.

His Lordship said that he did not think that there were any means by which the declarations he had made could be enforced. He had not granted an injunction. His judgment had no further operation than that it made it *res judicata* between the Attorney-General and the Corporation.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Aston Motor-Starters.

Messrs. Veritys, Ltd., of Plume and Victoria Works, Aston, have brought out a new series of starters for motors of all kinds, some of the designs being entirely new. In all of these the resistance is composed of open metal spirals supported on insulated iron carriers, up to 70 h.p., for which and higher powers cast-iron grids are used. These resistances are particularly easy to repair.

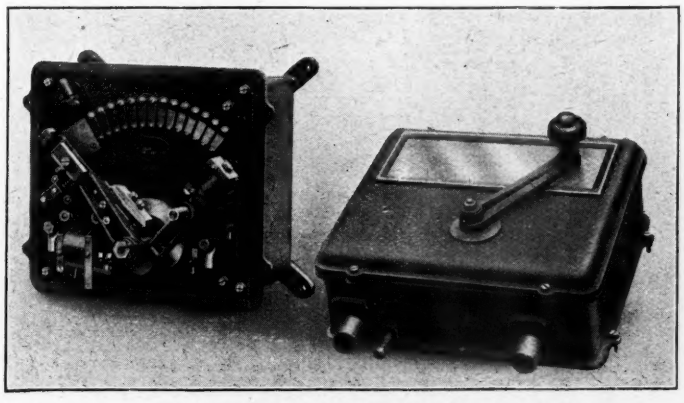


Fig. 1.—Verity's "Salford" Double-Arm 15-h.p. Motor-Starter.

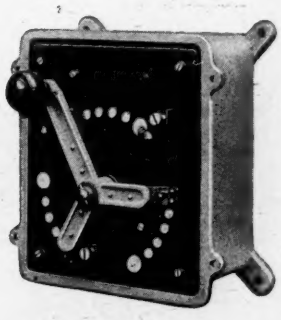


Fig. 2.—Aston Three-Phase Starter.

Simplicity and accessibility are the leading features of the new lines, which cover a wide range of requirements, and are entirely British-made. The accompanying illustration, fig. 1, shows one of the double-arm starters now made by the company; this is provided with a "totally enclosed" front having a glass inspection window, the lever being actuated from the outside. The special characteristic of this starter is that if an overload occurs during the act of starting, the follower arm is released and falls back to the "off" position. Both no-volt and overload release attachments are provided.

Fig. 2 shows a neat three-phase rotor starter for a slip-ring motor, with open front, but without automatic release. A variety of other patterns is made, as well as shunt regulators and combinations of starters and regulators.

Keyholder with Evans's Twin-Grip.

Some time ago we drew attention to the advantages of the twin-grip lampholder invented by Mr. H. E. Evans and introduced by Messrs. Bell Bros. & Co. (London), Ltd., of 63, Bishopsgate Street Within, E.C. This device does away with the risk of short circuiting in the ordinary cord-grip, and we understand that it has been largely specified by consulting engineers and others for recent installations. Messrs. Bell Bros. have now gone a step further and introduced a push pattern keyholder combined with the twin-grip, an illustration

Address

1st Application for 30-watt lamps H.P. Motors amp. Arcs amp. Radiator

2nd do. do. do. do. do.

1st CONSUMER. 2nd CONSUMER.

LAMPS.			MOTORS.		ARCS.		RADIATORS.		LAMPS.			MOTORS.		ARCS.		RADIATORS.	
C.P.	Carbons.	Metals.	No.	H.P.	No.	Amps.	No.	Amps.	C.P.	Carbons.	Metals.	No.	H.P.	No.	Amps.	No.	H.P.
8									8								
16									16								
25									25								
32									32								
50									50								
100									100								

Date
Service Cable
Lighting Meter Type Size No.
Power Meter Type Size No.
Fuse Box Type
Size of Fuses
Test
Connected by on

Date
Service Cable
Lighting Meter Type Size No.
Power Meter Type Size No.
Fuse Box Type
Size of Fuses
Test
Connected by on

No.....

Name Address Deposit

Date.	Meter Reading.	Units at 3d. £ s. d.	£ s. d.	Total. £ s. d.	Date.	Meter Reading.	Units at 3d. £ s. d.	£ s. d.	Total. £ s. d.

of which we give herewith. This device is substantially made and will, no doubt, be appreciated in the many cases where this class of switch-holder finds favour.

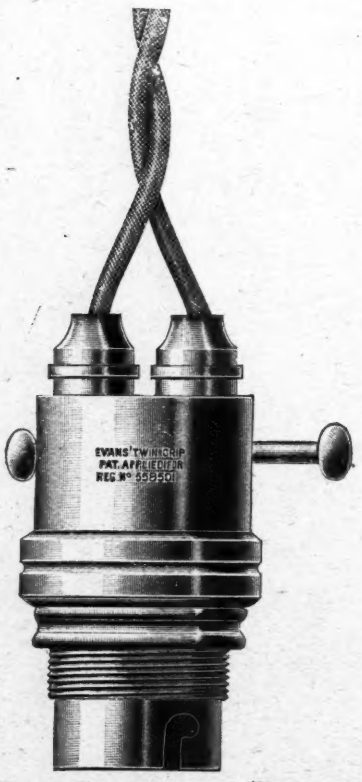


Fig. 3.—Evans's Twin-grip Keyholder.

Full particulars of this device, with prices, &c., are given on sheet 4, which will be supplied on application.

Country House Lighting.—Mr. John Richards, electrical engineer, of Burton-on-Trent, has been awarded a silver medal by the Staffs. Agricultural Society for his exhibit of a plant for a country house installation, at the recent show.

HANDY CARDS.

By "INTERESTED."

Where card systems are in use many half-hours may be saved by making summary cards, instead of writing the same particulars on about half a dozen different cards. These need not be specially printed, but a few plain cards held in reserve can easily be ruled according to the requirements of each special case.

Take, for example, a number of men engaged in laying mains or erecting arc lamp columns and lamps in the public streets, or working on five or six various jobs within one week, and assume that one cost card is given or used for each job, and that all the time worked and material used on the particular job is collected thereon. This means five or six cards with the same 20 or so men entered on each, which is not necessary. A wages summary card, made out somewhat like the following, would save a deal of unnecessary writing and time, as the 20 men would only appear once, and then on the summary card, and all that is put on the cost card proper is "Summary card—so much." This illustration clearly sets forth the meaning :—

.....Summary Card. Date.....

Check No.	J.O. No..	J.O. No..	J.O. No..	J.O. No..	J.O. No..	Totals.

Only one occasion is mentioned here by way of example, but, in a central station or works of any size, a little thought would often show up opportunities of saving unnecessary writing and useless duplication of figures. Of course, a special guide card will have to be used in the card cabinet for these summary cards, which can be arranged numerically, or in any other way thought best by the person using them.

Another card which might be classed as "handy" is the one shown at the top of this page.

As the diagram shows, one side is used for recording particulars contained on the consumer's application form, and space is provided for the mains engineer or superintendent to write thereon details and sizes of the consumer's meter, service cable, installation, &c. The ruling and general arrangement are such as to allow of the same card being used for two consumers at the same address, as in

the case of a house let in two parts, and also for premises where the tenants are frequently changing.

The extra size of the card, and the ruling, cost very little extra at the outset, and sometimes occasion arises when a few particulars relating to the previous consumer are an advantage. On the reverse side the pattern is arranged for the consumer's account of energy supplied, and requires no description, as all is plain sailing. Arranging the card in the manner described—viz., service notes on the one side, and the consumer's account made up on the other—saves the necessity for a second batch of cards or an extra book, where it is the practice to use both sides of one card for the account only.

Yet another useful little card, which takes up a very small amount of space in a cabinet, is the sub-station record described and shown below :—

SUB-STATION.

LENGTH. BREADTH. HEIGHT.

H.T. Board.									
Cables.									
Fuses.									
L.T. Board.									
Cables.									
Fuses.									

Transformer type..... Size..... No.....

Earth ..... Ventilator .....

Spare Pipes ..... H. T. Board divided.....

L. T. ,, ...

Date of Visit.	Remarks.	Inspector.

The first or front side is used for recording details of the size, equipment, &c., of the sub-station, and on the reverse the inspector or mains engineer enters from time to time the date of his visit to the sub-station in question, and also any remarks as to the state of fuses and the apparatus generally, and, in fact, any of the numerous notes required from month to month or week to week, as the case may be. This is a handy little record in the true sense of the word, because it forms a check on the visits by the inspector, as well as an account of the necessary repairs and alterations required or carried out.

BUSINESS NOTES.

Book Notices.—*The Felixstowe Electrical Bulletin.*—A neat little brochure has been issued by the Suffolk Electricity Supply Co., Ltd., Stowmarket, of which Mr. Napier Prentice is the engineer. It states in brief the advantages of electricity for lighting, heating and cooking, and contains numerous illustrations, accompanied by short descriptive notes in non-technical language, of the many devices which can be attached to an electric lighting circuit. We note that this enterprising company is even prepared to supply electricity to the owners of tents on the beach by temporary wires. It is interesting to see, too, that the local contractors support the undertaking by advertising in the brochure. Metal-filament lamps are put prominently in the foreground, and vacuum cleaners, cookers, irons, fans, illuminated signs, &c., are included amongst the items illustrated. A list of appliances useful to tradesmen is given. The Bulletin should prove useful as a business producer, and deserves our hearty commendation.

Universal Directory of Railway Officials, 1910. Compiled under the direction of S. R. Blundstone. London : Directory Publishing Co. Price 10s.—This is the sixteenth year of publication, a fact which renders comment unnecessary. The work includes practically all the tramways worked by power in the United Kingdom, as well as the railways of the world. There are several indexes, besides the directories for the different countries, and the personal index of railway officials alone occupies nearly 200 pages.

Galvanic Batteries and their Manufacture.—This is a reprint of an illustrated article in the *Electrical Magazine*, describing the many types of primary cells manufactured by Messrs. Siemens Bros. and Co., Ltd., at their Woolwich works. Copies may be had on application to Messrs. Siemens Bros. & Co.

Practical Electroplating. By G. Gentry. London : Percival Marshall & Co. Price 1s. net.—This is one of "Marshall's Practical Manuals," and gives in simple language directions for the amateur or beginner in the art. It deals with the deposition of silver, gold, nickel and copper, and besides sections on the elementary principles involved, and the methods adopted in practice, it includes working instructions for polishing metal surfaces. There is great scope in electroplating for the production of highly effective and artistic results, and the book may be recommended as an admirable guide to its technique.

"Die Ueberlandzentrale Besswitz" is a pamphlet which we have received from the Allgemeine Elektricitäts-Gesellschaft, of Berlin, and is of special interest in that it describes, with many illustrations, not only the "overland" hydro-electric station of Besswitz, but also the methods adopted for transmitting and distributing the electrical energy at 10,000 volts to the adjoining districts, and the many agricultural operations for which it is utilised. Motors of 1,656 H.P., and lamps equivalent to 466 KW., are supplied in the neighbouring village and farms, the prices charged ranging from 2½d. to 2d. per KW.-hour for power, and 4d. for lighting. Useful data are also given regarding the consumption of different machines. Leaflets relating to a new controller and to an automatic pumping system for the supply of houses with water have been received.

"The Oechelhauser Gas Engine in Great Britain."—Reprint of paper read by J. W. B. Stokes and J. Cunningham before the Glasgow University Engineering Society, November 11th, 1909. Glasgow : Messrs. William Beardmore & Co., Ltd.

"General Foundry Practice." By William Roxburgh. London : Constable & Co., Ltd. 1910. Price 10s. 6d. net.

"Industrial and other Aspects of the City of Aberdeen." 1909. Aberdeen : The Corporation. Issued gratis.—This is an admirable pamphlet designed to make known the attractions of Aberdeen as a suitable place for new industries, as well as a desirable place of residence. The population of the city has risen rapidly, being now 170,000, and the rates are only 5s. 8½d.

"*Transactions* of the South African Institute of Electrical Engineers." Vol. I, Part 6. May, 1910. Johannesburg : Published by the Institute. Price 2s.

"Leitfaden zum Elektrotechnischen Praktikum." By Dr. G. Brion. 1910. Leipzig : B. G. Teubner. Price M.10.

"Electro-Metallurgy." By W. G. McMillan and W. R. Cooper. Third edition. 1910. London : Chas. Griffin & Co. Price 12s. 6d. net.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVI, Part 8. July, 1910. London : Andrew Reid & Co.

"The Theory of Ionisation of Gases by Collision." By John S. Townsend. London : Constable & Co. Price 3s. 6d. net.

"The Physical Review." Vol. XXXI, No. 1. July, 1910. Lancaster, Pa. : The Physical Society.

"Science Abstracts." Vol. XIII, Part 7. July 25th, 1910. Sections A and B. London : E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"*Bulletin* of the Association des Ingénieurs Electriciens." July 20th, 1910. Liége : Rue Saint-Gilles, 31.

"Statistics of Electricity Works in Austria." 1910. Vienna : Selbstverlag des Elektrotechnischer Vereines. Price 2·50 K.

Boletin Tecnologico de la Asociacion de Peritos Industriales." Vol. XI, No. 61. July 20th, 1910. Madrid : Tuencarral, 137.

"*Proceedings* of the Physical Society of London." Vol. XXII, Part 2. July, 1910. London : Taylor & Francis.

"The Calculus for Beginners." By J. W. Mercer. London : Cambridge University Press. 1910.

German Enterprise in China.—The Siemens China Electrical Engineering Co. is the title of an organisation formed in Berlin under this English name as a limited company, and with a capital of £25,000. Its object is stated to be the sale of articles of manufacture by the Siemens-Schuckert Works, the Siemens & Halske Co., and Gebr. Siemens & Co., of Lichtenberg, as well as of the firms of Siemens Brothers & Co., of London, and Siemens Brothers Dynamo Works, Ltd., of London. Herr Karl Friedrich von Siemens is the manager of the new company.

Consular Notes.—Liberia.—The British Consul at Monrovia reports that direct cable communication with Europe was established by German cable, *viâ* Teneriffe, on March 21st, 1910. There are no local telegraph or telephone systems yet established.

Canary Islands.—The British Consul reports that the new German cable from Emden direct to Santa Cruz was completed in August last. As stated above, the line has now been extended to Monrovia, Liberia. The installation of a system of wireless telegraphy to Europe, Cape Colony and South America is now almost completed, and it is expected that communication between Teneriffe, Grand Canary and Cadiz will be established immediately ; the system adopted is the Popp system, and the radius of communication is 3,000 miles. The old steam tramway between Las Palmas and Puerto de la Luz, 3½ miles, is being electrified by a Madrid company, which has bought the concession, and it is expected that the electric cars will be running by June, 1910.

Hayti.—The British Consul reports that a concession for lighting the town of Port au Prince by electricity was granted in 1909. Some of the machinery has arrived, and it is hoped that lighting will be possible by the end of 1910.

Roumania.—The British Consul at Galatz reports that the dock administration are removing the steam cranes at present in use in the existing dock to up-river ports and will replace them by eight

F

new electric cranes. The British Consul at Sulina reports that an installation of electric light has been introduced at that town.

Italy.—The British Consul at Savona reports that the Italian State Railways have decided to extend the electrification of the Savona-Guiseppe railway to the station of Ceva; the total length of the electric line will be about 28 miles. The Consiglio Provinciale, of Genoa, has granted to a preliminary committee composed of several capitalists of Savona, a 30-years' concession for the construction and working of an electric tramway from Savona to Vado, with a branch to the Cemetery and Quiliano. A company is about to be formed with an initial capital of 800,000 lire, and it is hoped that by the end of 1911 the line will be completed and ready for use.

China.—The British Consul at Nanking reports that an electric light company, with native capital, was formed early in 1909. Machinery has been secured from the United Kingdom, and is now (March, 1910) being erected under the supervision of a British engineer. It is hoped to begin operations during the present year.

In a recent report, the British Consul at Newchwang writes regarding the openings for electrical goods in Manchuria:—"The prospects are hopeful, for in most of the large towns in Manchuria electric light and telephone installations are either already in existence or are contemplated. In almost every case, however, contracts are in Japanese hands, and the firms show no inclination to make use of or encourage the use by their clients of any other than Japanese material, which, though cheap enough, is not of the best quality."

France.—The British Consul at Nice reports that a tramway line from Nice to Antibes was completed and opened for traffic in February, 1909. The line from Vesubie to St. Martin Vesubie has been opened provisionally, steam traction being used for the present, but an electric installation is being proceeded with, and it is probable that electric traction will be started in the summer of this year. The construction of the Tinée Valley line (from Mesela to St. Sauveur) is nearly completed, and it will be opened to traffic—steam traction at first—some time before the end of the year. The construction of the lines from Cagnes to Grasse and from Cagnes to Vence, is in an advanced state, but they are not likely to be opened for traffic till next year, with the exception of the section from Grasse railway station to Pré du Lac, which is to be opened shortly. The line from Mentone to Sospel—by reason of the triumphs of engineering which it will exhibit, as well as the beauties it will present to admirers of the picturesque—will, perhaps, be the most remarkable of the many tramways by which the Department of the Alpes Maritimes is intersected. The work of construction is being actively proceeded with, and the opening will take place towards the end of the year. A start has been made with the construction of the lines of the Valley of the Var and Esteron. The methodical development of the network of telephones in the Alpes Maritimes has continued to make progress. A number of communes have been linked up with Nice, and the comprehensive scheme for the Department which has been sanctioned by the Conseil-General will be brought into complete operation in two or three years.

Palestine.—The British Consul at Damascus reports that the local tramways are gradually being more and more used by the public, and the mean of the monthly takings for the three years 1907-9, was about £790, £820 and £980 respectively. There are now 37 cars, of which 16 are closed cars, newly introduced last winter. The line along the Salahiyeh road (about 1¼ miles) was doubled last year. It is proposed to carry on (and a beginning is being made) the line both east and west of the head station at Salahiyeh to a distance of 1,880 metres (about 1¼ miles) as far as the Mosque of Muhreddine Arabi, by a new road through the gardens, and also about 1,100 metres (1,200 yards) westwards towards the house of Nazim Pasha. The company are also planning to extend the line from the Meidan terminus to both the railway stations of the Hejaz line and of the French company's line, which are only a few hundred yards distant, and facilities will be afforded for the transport of cereals thence to stores along the Meidan quarter. The question of building a line to Muzzel-Kassab, as also that of connecting with Duma, a township six miles north of Damascus, is suspended, as the terms of expropriation of land are still under discussion with the municipality. The receipts for electric lighting almost touched a total of £700 for the month of December last—the highest yet recorded. Nearly 1,300 private houses have electric lighting, with about ten lamps per house. The increased demand has been very marked lately. Motive power is also established, or being applied for, by four or five workshops, besides the Hejaz Railway workshops, which latter now pay at the rate of about £1,280 per annum for their supply. Thus the company is making very satisfactory progress in all three branches.

Japan.—The British Consul at Tainan reports that at the end of December, 1909, electric light was first seen in South Formosa. The power station is situated at Chikushimin, a little to the east of Banshoryo, whence electric light and power will be supplied to the towns of Tainan, Anping, Hozan and Takow. An irrigating canal 42½ miles in length is also to be constructed there, and another 85 miles long, to the south branch canals, drawing supplies from these main canals and destined to irrigate the whole neighbourhood. These canals will aggregate in length about four times that of the main canal.

Madeira.—The British Consul at Madeira reports that the concession recently held by the Madeira Electric Lighting Co., Ltd., has been transferred by the Camara to a company called the Madeira Electric Lighting Co. (1909), Ltd., which has been duly registered in London and Portugal. The capital of the new company has been guaranteed by a London company. It is the intention of the new company to increase the illumination of the street lights, and to keep the supply on the mains day and night, so that electric fans, electric irons for embroidery work, &c., may be used, and energy supplied to motors for use in any factories or mills where required. The present plant in the generating station will be scrapped, and plant of the very latest type put in to replace it. When the new plant is erected the mains will be extended to the whole of the Concelho of Funchal, so that residents in the mount district—St. Martino, St. Roque, St. Antonio, &c.—may have the electric light. There is a local advisory board of directors, composed of British and Portuguese, with Mr. A. Barron, M.I.C.E., as engineer-in-chief. From all one can gather, a telephone concession is to be taken over and worked by the Government, but when the system will be in working order it is impossible to say. It is stated that the cost will be about £4 12s. for each telephone, and on first installation a further charge of £1 4s. will be made. The system is to be worked in Funchal and district, and if successful will be further extended.

Russia.—The British Consul at Batoum reports as follows in connection with the possibilities for the investment of British capital in the district:—"In view of the many schemes which were before the Russian Government during the year 1909 for building steam and electric railways and tramways, constructing roads, establishing motor-car communication between points, constructing harbours, and for the development of municipal enterprises, mining and other industries in the Caucasus, many of which are likely to advance a stage or two during the present year, and some of them even progress sufficiently towards maturity to warrant a good deal of activity on the part of capitalists, I should fancy a wide field has thereby been laid open to British firms and financiers to become engaged in enterprises in this country, most of which, I think, if carefully handled, should give good results, but it should be borne in mind that many of the schemes, in making headway through the various stages through which they have to pass, are handled in the Russian capital, to which communications in connection with them should be addressed, seeing that any decisive and final decision on them will emanate from St. Petersburg."

The British Vice-Consul at Baku reports that the town of Baku, having raised a loan of some £2,842,000, certain sums have been set apart for the building of an electric station, the lighting of the town by electricity and the electrification of the tramways, &c., all of which will call for foreign supplies. It is intended to light the town by electricity by means of 960 arc lamps. Nothing definite has been settled as to whether the municipality will build its own power station or come to some arrangement with the existing power company. The question of the electrification of the tramways is also unsettled, as it depends upon the arrangements made as regards the power station.

In connection with the possibilities for British trade, H.M. Vice-Consul writes as follows:—

"It is only in motors, steam engines and tin that British imports hold their own, and as regards motors and engines, all credit must be given to the two or three firms that are working most energetically and have their own men on the spot. Undoubtedly British goods hold their own as far as quality is concerned, and most traders would prefer to deal with the United Kingdom on anything like the terms granted by our foreign competitors. I think the chief difficulties which beset us in this market, and which are fully overcome by other nations, are the following:—

"1. Our foreign competitors issue catalogues in Russian, with prices in roubles, goods delivered Baku or at least duty and freight paid Batoum, and weights given inclusive of packages. British traders invariably issue their catalogues in English with English currency f.o.b. British port, and very often no price list at all is given, but will be forwarded on application.

"2. British travellers are seldom seen here, and those that do work this district invariably require an interpreter.

"3. Local traders, especially the smaller houses, who have no English correspondent, do not know where to apply and have to rely on houses in the larger centres—having no facility of ever getting into direct communication. The addresses of various manufacturers can be obtained at the Vice-Consulate, but that is not all that is required. Our foreign competitors have houses here where samples can be seen, terms can be learnt, and in many cases stocks are kept.

"4. Terms and credit.—These are all-important factors. It must be remembered that the merchant here receives payment in from three to six months; therefore when he has to pay cash he is bound to ask an enhanced profit. Our foreign competitors understand this thoroughly and meet their customers in every way possible—in many cases paying both freight and duty. For instance, belting is forwarded here freight and duty paid and the agent pays the manufacturer from three to six months after the belting has been sold. It is quite understood that manufacturers with a small capital from which they require a quick turnover are unable to give long credits, but it seems within the bounds of possibility that an arrangement could be come to with banking firms whereby the manufacturer is able to obtain a part payment on the documents for his shipments being taken up.

"5. Another point to be borne in mind is the study of local conditions and what is required for the market. In this respect a great deal depends on the larger centres, such as Moscow. Dealers here do not carry large stocks and prefer to deal with firms having a head agency in Moscow, whence delivery can be effected in a week or 10 days in case of necessity, whereas at least two months must be reckoned from the United Kingdom.

"In all cases where credit is asked for, careful inquiries can always be made beforehand."

Spain.—The British Consul at Corunna reports that negotiations for the electrification of the existing five miles of the mule-drawn

tramways actually running in Corunna are still being continued. A Spanish syndicate has made an offer to the present owners of the concession, and a British syndicate has also offered to examine their scheme, but for the time being preference is given to the Spanish group. It is hoped that a settlement with one or the other of these offers will soon be reached.

The Vice-Consul at Concubion reports that direct telegraph wires connect Concubion with Corunna and Muros; there is further a direct wire to the Semaphore at Finisterre, and another wire which connects with Santiago *via* Muros.

The British Consul at Seville reports that electricity is being introduced there in various ways to lighten the labour on farms, more especially for the turning of the heavy wheels which draw water from the wells. The German company continues to enjoy a monopoly of providing electric power for Seville, and has further secured it by obtaining control of the power from La Hidro Electrica del Guardiaro. Thus the competition which it was hoped might tend to reduce the price has failed. At Algeciras an English firm has set up a new electric lighting installation and their competition with the old company is proving of great benefit to the town and the poorer section of the community.

The British Vice-Consul at Cadiz reports that the wireless telegraphy station at Puntales, though ready, is not yet open to the public; financial difficulties are delaying the completion of its principal object station, the Pico de Teire in the Canary Islands. Messages have been successfully sent to Paris, though none can yet be taken. The present management is in French hands.

The British Vice-Consul at Cordoba reports that serious efforts are being made there to induce foreign capitalists to establish a system of electric tramways in the town, to which end the local authorities are prepared to offer every facility possible. As a preliminary step they are opening up a new broad street into the heart of the city. Fuel, however, is very dear, and unless sufficient water power can be obtained at a reasonable price (which seems possible) and some other business combined with the working of the tramways, such as electric lighting or some manufacture, it could hardly be made to pay, the people being in no hurry to get from one part of the town to another and the distances being short. The streets are also extremely narrow, though wonders have been accomplished by the tramways in Seville in somewhat similar circumstances.

The Price of Platinum.—It is announced from Paris that, notwithstanding the dead season, the Compagnie du Platine maintains the high price of the metal, and the raw mineral continues to be bought for American account at high prices on account of the iridium contained in it. The quotation for platinum has never previously reached such a high position as at present. In the financial year 1908-9 the company began on October 13th, 1908, with a price of 3,400 fr. per kilogramme, which was increased gradually to 4,000 fr. in January, 1909. The quotation then declined temporarily to 3,800 fr., but in the summer it reached 4,000 fr., 4,250 fr., and 4,500 fr. The current financial year commenced on October 13th at 4,500 fr., in the winter it rose to 4,850 fr., and in May and June of this year to 5,000 fr. and 5,250 fr.

Trade Announcements.—Mr. H. L. Johnson, electrician, has opened new premises at 19, Tamworth Street, Lichfield.

The business of Mr. E. H. Pickford, electrical engineer, 264 and 266, Ecclesall Road, Sheffield, has been taken over by Messrs. Pickford, Trown & Co., Ltd.

The business of the late Mr. James Eddy, electrician, of Market Street and Commercial Road, Penryn (Cornwall), has been purchased by Messrs. Will J. Easom & Co.

The offices of The Bioscope are now situated at 85, Shaftesbury Avenue, London, W.C.

Mr. E. P. Allam has disposed of his entire interests in the Premier Electric Control, Ltd., and has now no connection with this company.

Holidays.—Messrs. Davis & Timmins, Ltd., King's Cross, London, N.—The works are closed from July 30th to August 8th.

The Electric & Ordnance Accessories Co., Ltd., Cheston Road, Aston.—The works and offices are closed until Monday morning, August 8th.

Insulating Varnish and Paint.—As recently mentioned, we received samples of their baking and insulating varnish, and air-drying insulating paint (Falcon brand) from Messrs. Wilkinson, Heywood & Clarke, Ltd., of 7, Caledonian Road, King's Cross; we have now examined these, and find them to be, so far as we can judge, in accordance with the makers' claims.

For Sale.—Messrs. Wheatley Kirk, Price & Co. have for disposal by auction, two 15-kw. Robey-Westinghouse generating sets. For particulars see our advertisement pages in this issue.

Patents in Holland.—Messrs. W. P. Thompson and Co., chartered patent agents, Liverpool, write as follows:—"The following is the text of the New Patent Act which has just passed the Second Chamber in Holland, and will almost certainly become law before the end of this year. A patent must be for a new product, a new process or a new employment of a product or of a process. In the word 'product,' however, a machine or apparatus is included, as these are the product of human workmanship; also a chemical product is included in this if it be not known before. The invention, however, must be an industrial application. A patent for a new process covers the article itself, provided it has been obtained by that process. The first applicant for a patent is held to have the right to it whether he be the inventor or not, but inventions to be validly patented must not have been publicly described or known in any way, so that they can be readily used by experts in the art. An invention, however, protected by anyone in any countries of the Conventin for the protection of industrial property is, *per se*, protected by that person in Holland for one year from the date of the first protection abroad, provided the patent be applied for within that year. If an employé of another person, firm or company take out a patent he must mention the name of his employer and the nature of his employment, and certain other particulars, and the employer can apply to have the patent granted to him on his paying a reasonable compensation to the inventor, and if this cannot be agreed upon, the Board of Examiners if desired by the inventor, will decide. The rules as regards international exhibitions, patents of addition, and the rights of an inventor are much the same as in England, except that a man who has begun to use the invention privately before the date of the patent, has the right to continue its use in his own industry provided he notifies the Patent Office within six months of the date of publication of the invention, giving satisfactory proofs thereof and such prior use does not make the patent invalid. Patents can be opposed within six months of their being allowed and thrown open to public inspection on the ground that the invention or part of it has been taken from the opposer by the opponent or that he is a joint inventor. There is a compulsory clause obliging inventors who have not worked their inventions sufficiently in the realm by the end of three years to grant licences to other parties on satisfactory terms; also patentees of improvements on the invention can obtain compulsory licences at reasonable rates, but the patentee of the improvement must in such case license his invention to the inventor. The Board of Examiners decide the terms of the licences in each instance. There are annual taxes gradually increasing each year. Patented articles must be marked in such manner as the Patent Office may appoint. Infringements and false marking is both a civil and criminal offence, and entails damages. Within five years of the date of the patent the patent must be worked *bonâ fide* in an industrial establishment in the realm, otherwise the patent can be revoked. A patent can be extended on application to the Dutch East Indies, Surinam and Curacao."

Bankruptcy Proceedings.—Harold Sheen Martin, Rock Park, Rock Ferry.—This debtor, examined at Birkenhead Bankruptcy Court on Friday, last week, on accounts showing liabilities amounting to £189, assets estimated to realise £1,054, and a surplus of £864, said he was an electrical engineer, and commenced business in Fontenoy Street, Liverpool, in 1898 with practically no capital. He spent two years in South Africa, and on his return found that the business owed a lot of money. Subsequently he was joined by a partner, who put £500 into the concern, but a year later the partnership was dissolved, debtor agreeing to pay his partner £250 and take over the liabilities and assets. The money, however, was never paid, and in April, 1907, debtor executed a deed of assignment, his liabilities being £1,156, and assets £277, a dividend of 8½d. in the £ being paid. Debtor later took out a patent for an electric economiser, which he sold to a company, receiving £1,000 fully-paid shares and £160 in cash. He mortgaged the shares, and with part of the proceeds took up another 100 shares. At present he was the manager and a director of the company, receiving £2 per week. As a scheme for payment of debts in full was proposed, the examination was adjourned for this to be carried out.

W. L. Grimsley, electrician, Springbourne.—A receiving order was made on the debtor's petition on July 20th, at Poole. The first meeting was held on July 30th, and the public examination will take place on August 26th at the Town Hall, Poole.

H. J. Burdett, electrical engineer, Coventry.—Last day for receiving proofs, August 10th, 1910; trustee, A. Cripwell, 12, Cherry Street, Birmingham.

Platt & Bleasdale, electrical engineers, Bolton.—Notice is given of first and final dividend of 7s. 3d. in the £, payable on August 11th, at 10, Acresfield, Bolton.

H. K. P. Barham (South of England Electrical Engineering Co.), electrical engineer, Portsmouth.—Application for discharge will be heard on October 13th, at Portsmouth.

Felgate & Storey, electrical engineers, and A. E. Felgate, Reading.—Last day for receiving proofs, August 5th, 1910. Trustee, B. P. Allnatt, 2, Forbury, Reading.

Dissolutions.—Fox & Co.—The partnership between W. J. R. Fox, Jun., and Arthur Brooke, electrical engineers, Batley, has been dissolved by mutual consent; the latter will attend to debts.

G. H. Freeman & Co.—The partnership between E. E. Jennens, A. E. Summers and G. F. Summers, electrical and general engineers, Gosta Green, Birmingham, trading as above, has been dissolved by mutual consent.

Plumb & Horsfield.—The partnership between J. A. Plumb and F. W. Horsfield, electrical engineers, Newman Street, London, has been dissolved by mutual consent.

LIGHTING and POWER NOTES.

Aberdeen.—The Electricity Committee does not think it desirable at present to join in the promotion of the Bill proposed by the Incorporated Municipal Electrical Association.

Accrington.—The Electricity Committee has agreed upon terms at which it is prepared to supply electricity in bulk to

the Haslingden Corporation, and has also decided, with a view to giving effect to the proposal, to apply to the Board of Trade for an order under Sec. 4 (3) of the Electric Lighting Act, 1909, permitting the Corporation to give the supply.

Consideration was given to the question of renewing the storage battery at an estimated cost of £2,200, after deducting the proceeds of the sale of the old plant. It was eventually decided that a new storage battery be installed, the cost to be defrayed out of revenue.

Barrow-in-Furness.—The Chamber of Trade has passed a resolution protesting against the proposed promotion of a Bill in Parliament giving powers to public bodies to provide and deal in electric lamps, meters, and fittings for lighting and power. The T.C. has decided to support the Bill, and to favourably consider financial support.

Beaconsfield.—The U.D.C. has received from the Uxbridge and District Electric Supply Co. and Callender's Cable and Construction Co. notice of their intention to apply to the B. of T. for a prov. order for E.L. The Council has reserved its decision as to opposition or support until the September meeting.

Bispham.—At the Council meeting on July 28th, a protest was made against the alleged inactivity of the Council regarding the supply of electricity for the district, one resident stating that it had resulted in him failing to let his houses. The chairman said the Council had just passed a resolution that the Local Government Board be asked to sanction a loan in order that it might proceed with the electric lighting scheme. It would be folly for the Council to put down more gas lamps than it could help, especially as the Council would be proceeding with the electric lighting scheme.

Bradford-on-Avon.—Both the U.D.C. and the R.D.C. have received notices from the Western Electric Distributing Co., Ltd., of its intention to apply for prov. orders for electric supply.

Bradford.—The ceremony of starting up the two new 5,000-H.P. vertical B.T.-H. Curtis turbine sets at the Valley Road works, took place on July 27th, in the presence of a number of guests invited by the Electricity Committee. We notice that one of the new sets was not inappropriately named "Annie Hustler." Each machine generates three-phase current at 6,600 volts, the normal rating being 3,000 KW. Space is available for a third similar machine, and it is interesting to record the remarks of Mr. Roles, the city electrical engineer, at a tea which took place subsequently at the Town Hall, that the cost of the turbines, with their pumps, condensers and accessories, and the building housing them, per KW. installed, was less than the cost of the building alone for the remainder of the engine room. It is expected that the introduction of this plant will have a marked effect in reducing the generating costs. The balance-sheet for the year ending March 31st last shows that the net profit on the electricity department reached a sum of £7,399, as compared with £2,146 in the preceding year. The income amounted to £113,983, an increase of £3,740; while working expenses were less by £1,284. Interest and sinking fund charges totalled £55,736, a decrease of £230. The increased income is attributed to bulk supply and power consumers, to whom a reduction in charges has recently been made. We notice that the Corporation is now advertising its "power" for manufacturing purposes in the local papers.

Chelmsford.—The Electric Supply Corporation, Ltd., has offered to light the north and south wards of the town with 21 flame arc lamps at £25 5s. per lamp per annum, with 23 incandescent lamps at street corners of 200 Hefner C.P., and with 280 incandescent lamps of 100 Hefner C.P. at £3 3s. per lamp per annum; to light the Shire Hall clock at £5 10s. per annum; and to provide 33 incandescent lamps of 100 Hefner C.P. in the Springfield Ward at £3 3s. per lamp per annum.

Continental Notes. — AUSTRIA - HUNGARY. — H.M. Consul-General at Budapest (Mr. Esme Howard, C.V.O., C.M.G.) reports that the municipality of Budapest has been negotiating for some time past with a view to taking over the remainder of the concession of the two great electric supply companies of that city, and so to municipalise the electrical supply. It appears now that no agreement could be reached, and that the municipality is consequently considering a project for the erection of a third electric power supply establishment, which would be under municipal control.—*Board of Trade Journal.*

Eccles.—The T.C. has received from the L.G.B. sanction to a loan of £1,927 for generating plant, &c., and £1,307 for mains extensions.

Fleetwood.—A L.G.B. inquiry is being held into the application of the Town Council for powers to a sum of £4,100 for the purpose of extending the electric lighting undertaking. The additional plant is rendered necessary owing to the increase of private consumers, while it is stated that several important customers, notably the Fylde Ice and Cold Storage Works, have intimated that they will shortly require a supply of current.

Frome.—The U.D.C. has sealed an agreement transferring the electricity works to Messrs. Edmundson, the contractors, who are to receive from the Council the sum of £8,278, the balance of the capital amount due to them. The Council agrees to take current for public lighting until 1928, and the company agree to repay in half-yearly instalments the interest and sinking fund, or instalments or loans, amounting to £43,278, which the Council has incurred. It is also agreed that the Council may at any time, if thought desirable, resume the undertaking on valuation.

Glasgow.—It was reported at the last meeting of the T.C.'s Electricity Committee that the treasurer had borrowed £35,000 from the Corporation Loans Fund, for capital purposes, making the total borrowed up to date £1,955,000.

The Committee has had under consideration the draft annual accounts for 1909-10, which showed the following proposed rates of depreciation on the various items in the capital account for the year 1909-10, viz.:—Lands and buildings, 1 per cent.; machinery, plant, instruments, transformers, &c., 3½ per cent.; accumulators, 5 per cent.; mains and cables, 2 per cent.; meters and indicators, 4 per cent. After consideration the Committee approved of the foregoing rates of depreciation for 1909-10. On the basis of the rates for 1908-9 the depreciation for the year 1909-10 would be £57,930 18s. On the basis now proposed by the Committee the amount will be £43,474 18s., or a difference of £14,456. It was decided that the rates for electricity for lighting and power for the year should remain unchanged.

Grangemouth.—Work in connection with the installation of electric light for the town is being pushed on rapidly by the contractors, the Scottish Central Electric Power Co. The construction of the sub-station is almost complete, and it is expected that a supply of electricity will be given this month.

Lancaster.—The E.L. Committee has decided to spend £200 for balancer gear, to be paid for out of the reserve fund.

Leicester.—A L.G.B. inquiry was held on Friday last into the application of the Corporation to borrow £19,190 for the purposes of the electricity undertaking. The inquiry was conducted by Mr. A. A. G. Malet, M.Inst.C.E. The application was in connection with the proposed installation of additional generating plant at the tramways generating station and the extension of the buildings to accommodate such plant. The only opposition to the application was offered by Mr. S. M. Lakin, who thought there was no necessity for the Council's proposed scheme in view of the amount of power available at the Aylestone works.

Littleborough.—The Electricity and Tramways Committee has decided to advertise that the Council will be in a position to supply electricity by a certain date, and offering special terms to those persons who apply, before the mains are laid, for their premises to be connected.

London.—Mr. Sumner, the City engineer, in his annual report, mentions that most of the main thoroughfares are still lighted by electricity. The number now in use of the original type of open electric lamps costing £26 each, is 366. In addition there are 63 "Oliver" flame arcs (partly experimental), and 18 "Reason" enclosed arcs (experimental). The Charing Cross and Strand Electric Supply Co. is lighting Cannon Street with eleven magazine "flame" arcs at £17 10s. per lamp per annum. The City of London Electric Lighting Co. is experimenting with 21 "Oliver" flame arcs in Holborn and Holborn Viaduct, and with 18 "Reason" arcs in Farringdon Street for £17 10s. and £12 10s. each respectively. The number of gas lamps in use is 2,720. Fleet Street and Chancery Lane have 17 high-pressure inverted gas lamps of the "Keith" type at £15 2s. 6d. per lamp per annum. There are 102 other high-pressure "Keith" gas lamps in the City, costing £6 13s. 6d. per lamp, and 45 upright two-burner lamps in Queen Victoria Street, costing £12. The number of low-pressure gas lamps in use is 2,601, costing £3 5s. 7d. each.

ST. PANCRAS.—The borough treasurer, reporting on the accounts of the electricity undertaking for the year ended March 31st last, says the gross income for the year amounted to £76,972, which is an increase of £1,613 over the previous year and a decrease of £629 as compared with two years ago. After meeting working expenses and repayment of loans and interest, a profit remained of £9,506 as compared with £7,126 in the previous year and £9,454 in the year before. The income included £61,276 from private lighting, as against £60,635 in the previous year, while the amount received for public lighting was £13,368, as against £13,367. Working expenses and cost of maintenance came to £40,746, as against £42,469 12 months before. The Electricity Committee has written off out of the balance of £9,506 for the year, the sum of £846, balance of a loan in regard to a Ledward condenser, and £700 off the capital value of meters, and has adjourned to the next meeting the consideration of the disposal of the remainder of the balance.

HOLBORN.—The B.C. at its last meeting rejected, by 15 votes to 6, a recommendation of the Works and General Purposes Committee to enter into a contract for 10 years with the Gas Light and Coke Co. for street lighting with inverted burners. It is understood that the matter is to be brought up again in October, and that in the meantime the Electric Lighting Co. will submit a competitive tender. The borough surveyor reported have prepared an estimate of the cost of alternat ive systems of electric lighting applied to High Holborn and New Oxford Street only as follows:—By existing lanterns adapted, 18,000 C.P., first cost £75, annual cost £483; by new standards for arc lighting, 40,000 C.P., first cost £800, annual cost £680; by new suspended lamps for ditto across street; 40,000 C.P., first cost £290, annual cost £680; by flame arc lighting, 120,000 C.P., first cost £1,000, annual cost £680. The Committee considered that the adoption of either electric light or high pressure gas would involve considerable expense and the disturbance of the pavements, and it therefore did not recommend either.

MARYLEBONE.—The general manager of the electricity undertaking reports that although the electric hot water apparatus is now in use in the Town Hall, and there is nearly double the candle-power available for lighting, the cost for the June quarter of this year was £24 6s. 8d., as against £26 8s. 10d. in the corresponding

period of 1909. An agreement has been entered into for the supply of electricity to the London Polytechnic's new premises in Regent's Street under a restricted hour basis.

Long Eaton.—At a meeting of the U.D.C. last week, the electrical engineer reported an increase in the number of units generated, and the Electricity Committee recommended that the engineer be instructed to prepare a scheme and estimates of the necessary extensions of the electricity works. The report was adopted.

Luton.—The T.C. has fixed the following alternative charges for current for private houses: Lighting and heating combined—For the two summer quarters (April to September), 6d. per unit for the first 70 hours of the average maximum demand per quarter, and ½d. per unit afterwards; for the two winter quarters (December to March), 6d. per unit for the first 70 hours, 1½d. per unit for the next 300 hours, and ½d. per unit beyond.

Mexico.—The Potosina Electric Co. will shortly complete its 60,000-volt transmission line and receiving end at San Luis, Potosi, for the Guanajuati Power and Electric Co.; the line is designed with suspension type insulators for 100,000 volts.

Plymouth.—The Mercantile Association has decided to ask the local members of Parliament to oppose the suggested Bill of the Municipal Electrical Association to give local authorities power to deal in lamps, fittings, &c.

Sevenoaks.—The U.D.C. has decided, by five votes to four, to apply for a prov. order for electric lighting.

Southampton.—The Electricity Committee has presented a report from the borough electrical engineer, stating that he would be glad if an arrangement could be made so that when extensions were made through roads at present lit by gas it would be understood that the gas lamps in question should be changed over to electricity without special application to the Works Committee. On the report of this Committee coming up for consideration, it was decided that when electric mains were laid in the roads, that the public lighting should be connected with the electric mains, and so deal with the matter forthwith.

In connection with the proposed duplication of the high-tension feeder to the Portswood district, a small sub-station is to be erected in the Portswood tramway depôt for switchgear and transformers. Beaumaris Hall has been purchased for the purpose of conversion to tramway offices.

Southend.—A L.G.B. inquiry was held on July 26th into the application of the T.C. for a loan of £20,467 for electricity purposes. There was no opposition, but the Inspector (Mr. H. R. Hooper) suggested that the cost of meters and street lighting, for which £4,000 was asked for, should be paid out of revenue, and it was decided that the £4,000 should be appropriated for services.

Southgate.—At the last meeting of the Urban District Council the agreement with the North Metropolitan Electric Power Co. was sealed. It was explained that by the agreement the company was bound to lay the mains within 18 months, but the chairman said that he was informed on reliable authority that the mains would be completed and the electric light would be available by the new year.

Stoke-on-Trent.—The Federated Council has decided not to financially support the Incorporated Municipal Electrical Association in the promotion of a Bill to enable local authorities to provide, let out on hire, and fix, repair, and remove lamps, meters, and other fittings, &c., for lighting, power and other purposes.

Torquay.—A L.G.B. inquiry was held last week into the application of the T.C. for a loan of £3,500 for cables, transformers, house services and meters, a portion being in connection with the extension of the mains to Chelston. The Inspector (Mr. Hooper) suggested that transformers, house services and meters should be bought out of revenue and the capital kept as low as possible. Ultimately the loan was amended.

Trowbridge.—The U.D.C. has decided to oppose the application of the Western Electric Distributing Corporation for a prov. order for electric light.

West Bromwich.—The Electricity Committee recently received from the Shropshire, Worcestershire and Staffordshire Electric Power Co. an offer to supply the Committee with electricity in bulk, to take the place of the extensions to generating plant and mains which the Committee is making. The prices tendered by the company were carefully considered, but the Committee came to the conclusion that they were far too high to be entertained for a moment, and the offer has, therefore, been declined.

West Ham.—Application is to be made to the L.G.B. for sanction to a loan of £1,500 for cooling water supply at the generating station. This loan is to be added to an application for £52,000 already before the Board. The borough treasurer reported at the last meeting of the Council having received a letter from the electrical engineer as to proceeding with certain works included in the application for loan sanction, and stating that the most important matters appear to be the Silvertown and Stratford extensions. A deputation from the Council, headed by the Mayor, is to interview the President of the L.G.B. with a view to obtaining the necessary sanction as soon as possible. The electrical engineer gave the Committee figures showing a comparison between the cost to be defrayed each year if purchase of meters is made direct from revenue or on the basis of five years' loan, and pointed out that these figures showed that while the average increase over the five years' period by paying out of revenue on this basis is 30 per cent., the increase for the earlier years is much more, amounting in the first year to 300 per cent. It was decided that in future the cost of meters be charged direct to revenue. The chairman of the Electricity Committee and the electrical engineer were empowered to accept the most favourable tender for ash conveyors at the generating station. It was announced that in regard to a bulk supply to the Port of London Authority, the heads of the agreement had been arranged subject to approval by the various authorities interested. The Electricity Committee has decided to support the Incorporated Municipal Electrical Association in securing the passing of an Act to amend the Electric Lighting Amendment Act, 1909.

A L.G.B. inquiry was held into the application of the Corporation to borrow £53,000 for the electricity department, on July 27th. Mr. Elvey Robb, representing the India-Rubber Co., large ratepayers, questioned the engineer as to the rates for power supply; eventually the Inspector decided to report to the L.G.B., leaving it to decide if a further inquiry shall be held.

Weymouth.—The T.C. has received from the L.G.B. sanction to a loan of £150 for tools, &c., for the electricity works.

Wrexham.—The borough electrical engineer, in a report to the T.C. respecting the electricity works, suggests application to the L.G.B. for sanction to borrow the sum of £3,345 for the purpose of developing the undertaking. The works, he states, are now laid out on a good commercial basis, and their business was increasing, while their expenditure was not increasing in anything like the same proportion.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—In a statement on tramway management, Mr. R. Stuart Pilcher, manager of the Corporation tramways, says he considers it is a mistake to be always altering the fares on any tramway system, as it unsettles the public when short stages are constantly being changed.

The Corporation Tramways Committee has had the question of car-shed accommodation under consideration, and has agreed to extend the depôt at Queen's Cross at a cost of £1,625. The Committee anticipates a saving of £175 due to the concentrated service.

The Corporation tramway accounts show that the total revenue for the year ended May 31st amounted to £71,121, compared with £71,679 for the previous year. The decrease is explained by the fact that in the previous year the Highland Agricultural Show was held in Aberdeen, and was worth £500 to the department. The working expenses amounted to £40,451, an increase of £257 over the previous year. The working expenses, it was pointed out, would have been much higher if it had not been for the reduction of £1,124 in the cost of the current. Interest and sinking fund charges amounted to £16,051, a decrease of £531. The decrease in capital charges is mainly due to the reduction in interest on mortgages and loans, the balance for the year being £14,653, a decrease of £284. The renewal account now stands at £58,576. The cars ran 25,068 extra miles on the Mannofield route. The receipts for parcels were £353. The 1d. fare system was introduced in September, 1909, so that the report includes only nine months' working of the new fare system. On the old system of fares the charge per mile of the 1d. fare was ·76d. On the new fare system the charge per mile has been reduced to ·55d., which compares very favourably with towns which have the cheapest fares in the country.

Bournemouth.—The general manager (Mr. Chas. W. Hill) at a meeting of the Town Council, held on July 26th, reported that during the ten days of the fetes, the receipts amounted to £6,100. The number of passengers carried was 897,000, and the receipts per car-mile averaged 22d. It was decided, on the recommendation of the Tramways Committee, that all members of the traffic staff and others who had been called upon to perform exceptional duties during the Centenary period should be paid extra remuneration at the rate of one day's full pay each. In reply to questions, Councillor Bell (chairman of the Tramways Committee) supplemented the general manager's report by stating that the traffic receipts from July 6th to 20th last year amounted to £3,538, while for the same 15 days of the present year the amount was £7,602, showing an increase of £4,063. The number of passengers for the same period was 541,490 in 1909, and 1,068,569 in the present year.

Bradford.—The report of the Corporation deputation which visited the Continent in November last year for the purpose of studying railless electric traction systems, &c., has now been issued in pamphlet form. The deputation inspected the "Mercedes Stoll" system at Vienna, the "Filovia" system near Milan, and another system in use by the Mülhausen Corporation, in addition to various Continental tramway undertakings, and a good deal of interesting data has been accumulated as a result.

Cardiff.—The city treasurer's report on the year's working of the Tramway Department shows a total income of £130,565, or £6,714 in excess of the previous year. Included in the total is £14,188 for energy supplied to the Electric Lighting Department

Working expenses amounted to £74,378, and a net balance of £56,187 remained. Loan charges were only £532 in excess of the previous year, and the net surplus amounted to £11,032, which was appropriated as follows: £6,937 to the depreciation fund and £4,094 to reserve. Mr. Ellis, the manager, points out that the 26 million passengers showed a reduction of 24,000 in the total, compared with a reduction of 200,000 in the previous year before the fares were increased. The surplus is a record one.

Glasgow.—At its first meeting the T.C. will be asked to approve of a recommendation that a by-law be enacted making it a punishable offence for any person, while travelling in or upon any of the Corporation cars, to spit therefrom.

For some time past the Tramways Committee has been considering representations made by the National League of the Blind regarding free travelling on the cars for the blind, and has now decided to recommend that blind persons, properly authenticated and accompanied by a guide, be allowed to travel free on the Corporation's cars—the guide to be charged the usual fare.

Further deputations have been received as to the proposals to extend the ½d. stages, and the Committee is considering the arguments advanced in Council with the general manager.

London.—A collision occurred on Tuesday morning between two trains on the City and South London Tube at a point between King's Cross and the Angel station. The rear of a stationary train was damaged, but the passengers escaped injury.

At the meetings of the Chatham and South-Eastern Railway Companies, both chairmen, referring to the question of electrification, advocated the popular policy of "wait and see." The South-Eastern Co. has lost traffic along the Victoria-Peckham route due to the competition of the Brighton Co.'s South London electric line.

Preston.—At the T.C. meeting on July 28th, Councillor Crompton drew attention to the result of the express parcel delivery system on the tramways, introduced at the beginning of the year. They had carried between 3,000 and 4,000 parcels, but had found that the minimum charge of 2d. per 14 lb. was rather prohibitive. They, therefore, proposed to reduce the minimum charge to 1d. for 7 lb., believing that this arrangement would have the effect of largely increasing their revenue from this source.

TELEGRAPH and TELEPHONE NOTES.

Derelict Wires.—According to the report of the Public Health Department of the City of London, last year over two miles of derelict or disused overhead wires across City streets were removed by the City Engineer's officials, making 25 miles during the last 10 years. About 733,956 spans of wire cross the public thoroughfares. Last year 5,765 cases of broken wires were reported. The City Engineer mentions the erection, for experimental purposes, of various aerial lines for intercepting wireless telegraphic and telephonic messages.

London-Berlin Telephonic Communication.—Mr. Braun, of the Berlin State Telephone service, is reported to have stated, in the course of a recent interview, that trials have taken place in the direction of telephonic communication between Berlin and London, over both the Belgian cable and the French cable, but the audibility was insufficient. It is intended to make extensive trials of conversation by means of the new loaded cable, and it will depend upon the results what lengths of overhead lines can be connected with the cable, and whether it will be possible to undertake telephony between German cities and London *viâ* the French cable. It is added that loading coils are already provided in the lines connecting Berlin and Stralsund, and Berlin and Frankfort-on-Main.

Telegrams by Telephone.—The P.M.G. is urging the desirability of substituting the telephone for the boy messenger, for the delivery of telegrams, the written telegram being forwarded by post, and the method is being adopted experimentally in the case of telephone subscribers in certain districts. The Post Office also forward telegrams in writing to subscribers of the National Telewriter Co., by means of their instruments.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—August 16th. Bare hard-drawn copper cables (3 tons 2 cwt.) for the Corporation of Melbourne. See "Official Notices" to-day.

August 23rd.—4,840 yards single conductor lead-covered cable (460 volts), and 880 yards concentric lead-covered cable (2,000 volts), for the Corporation of Melbourne. See "Official Notices" to-day.

September 7th.—Battery material and glassware for P.M.G.'s Department in Queensland. See "Official Notices" July 22nd.

August 30th.—Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" July 29th.

September 20th.—Telegraph and telephone material, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

Belfast.—August 10th. Twenty-two flame arc lamps, for the Harbour Commissioners. See "Official Notices" to-day.

Belgium.—September 11th. Tenders will be received at the "Direction Générale des Ponts et Chaussées, rue de Louvain, 38," Brussels, up to September 11th, for the supply and installation on the tidal quay at Ostend of four electric travelling cranes. A deposit of 9,000 francs (£360) will be required with each tender. Tenders will be opened at 11 a.m. on September 15th. The *cahier des charges* (No. 54 of 1910) may be obtained, on payment of 40 centimes (4d.), from the "Bureau central des Renseignements, rue des Augustins, 15," Brussels.—*Board of Trade Journal.*

The municipal authorities of Hollogne-aux-Pierres (province of Liége) are inviting tenders until the 27th inst. for the establishment of a central electric lighting station in the town.

Blackburn.—August 8th. Steam coal for a year, for the Corporation electricity works. P. P. Wheelwright, engineer and manager, Jubilee Street works.

Brazil.—According to the *Jornal do Commercio* of June 28th, in view of the excellent results that have attended the trials of wireless telegraphy on the Madeira-Mamoré Railway, the Minister of Public Works has been authorised by the President of the Republic to receive proposals for the installation of radiographic stations (Marconi system) in the three prefectures of Acre. The Acting Consul-General adds that there may or may not be a public call for tenders in this connection.—*Board of Trade Journal*

Bristol.—August 10th. Electric wiring at the Exchange, for the T.C. H. Faraday Proctor, engineer and manager, City Electrical Engineer's office, Temple Back. (Returnable deposit of £1 1s.)

Chelmsford.—August 31st. Supplying and fixing wiring for lighting Trinity Road Schools by electricity, with alternative tenders for gas lighting, for the T.C. W. H. Pertwee, architect, The Institute, London Road, Chelmsford.

Dublin.—August 24th. Wiring and fittings for electric lighting of the workhouse, James's Street, for the South Dublin Union. See "Official Notices" to-day.

France.—November 1st. The Prefect of the Department of the Yonne, at Auxerre, is inviting offers for the construction of a system of metre-gauge electric or steam railways in the Department, the aggregate length of the proposed lines being about 233 kilometres.

Gosport.—August 11th. Wiring and fitting-up the offices of the U.D.C. for the electric light. The Surveyor to the Council.

Hungary.—August 16th. The municipal authorities of Tolun are inviting tenders for the establishment of a small central electric lighting station in the town.

London.—L.C.C.—August 30th. Wiring and fitting for electric lighting of the second section of the Woolwich Road car depôt. See "Official Notices" July 22nd.

August 30th.—Covering cables with asbestos tape. See "Official Notices" to-day.

Newport.—August 15th. Carbon-filament lamps, radiator lamps, flame arc carbons, and alternating and direct current two-rate and prepayment meters, for the Electricity and Tramways Committee. See "Official Notices" July 22nd.

New Zealand.—Power-house plant, cars, trucks and equipment, rails and fishplates, trolley wire and feeder cable, for the Invercargill B.C. See "Official Notices" July 15th.

December 15th.—Installations of wireless telegraphy at Doubtless Bay, Gisborne, Cape Farewell, Sumner and Bluff. See "Official Notices" to-day.

Oldham.—August 17th. Construction of tramway (except electrical equipment), Ripponden Road, for the T.C. Borough Surveyor. (Returnable deposit of £1 1s.)

Rainhill.—August 25th. Telephone apparatus and cable at the County Asylum, for the Lancashire Asylums Board. See "Official Notices" to-day.

Salford.—August 15th. 500 tons of steel tramway rails, for the T.C. General Manager, 32, Blackfriars Street.

Spain.—August 16th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the establishment and working of a telephone line in the Linares district.

The municipal authorities of Benejuzar (province of Alicante) have just invited tenders for the concession for the electric lighting of the town during a period of 15 years. Tenders have also lately been invited for the concession for the electric lighting of the town of Sampedor (province of Barcelona) during a period of 20 years.

CLOSED.

Beckenham.—The U.D.C. has accepted the tender of Messrs. Oscar Jones & Co. for wiring the Alexandra schools for the electric light for which a loan of £202 has been sanctioned.

Belgium.—Five concerns submitted tenders to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the establishment and equipment of a transformer station in connection with the electric railways in the Bruges district, the lowest being that of the Compagnie Internationale d'Electricité, of Liége.

Bridlington.—The T.C. has accepted the tender of the British Westinghouse Co., Ltd., for metallic-filament lamps for a year.

Canada.—According to "Canada," Messrs. Mussens, Ltd., of Montreal, have been awarded the contract for 11 electric cranes, which will be supplied by Messrs. Booth & Bros., Rodley, Leeds.

Delagoa Bay.—The Chloride Electrical Storage Co., Ltd., are supplying a battery and Entz booster equipment.

Ealing.—The following is a list of tenders received for condensing plant for the Electricity Works :—

		Alternative.
Browett, Lindley & Co.	£2,700	—
Cole, Marchent & Morley	2,605	—
Davenport Engineering Co.	2,410	£1,984 10
J. P. Hall & Sons	2,385	—
Mirrless, Watson & Co., Ltd.	3,050	—
Ledward Beckett, Ltd.—Evaporative condenser	7,100	—
L. Schwarz & Co.	3,308	2,529
I. Storey & Sons	3,141	—
J. G. Weir & Co.	3,670	—
West London Engineering Co.	1,965	—
Willans & Robinson, Ltd. (accepted)	2,095	—
Worthington Pump Co., Ltd.	2,730	2,160

Glasgow.—The Tramways Committee has recommended the following for acceptance :—

Lead-covered power cable.—British Insulated and Helsby Cables, Ltd.
Section pillar castings.—Messrs. David King & Sons.
Slate slabs.—Messrs. Johnstons, Ltd.

Grimsby.—The T.C. has accepted the tender of Accumulator Industries, Ltd., for the supply of metallic-filament lamps for street lighting ; also the tender of Mr. E. A. Hall for fixing two 18-in. fans in the Council Chamber, at £20 2s. 6d.

Hendon.—The Council has accepted the tender of Messrs. Waring & Gillow for the installation of electric light throughout the whole of the Council's offices which were before lighted with gas.

Leith.—An order has been placed with the British Westinghouse Co. by the Corporation for additional plant for the town electricity works. The tender amounts to £4,775, and is for a mixed-pressure turbine and direct-current generator, complete with all the accessories for tramway and lighting supply. The new turbine will chiefly be run with the exhaust steam from the existing reciprocating engines, and is provided with condensing plant and cooling towers.

Leyton.—The U.D.C. has accepted the tender of Messrs. Headland & Headland, at £9 10s., for a supply of 32-C.P. tantalum lamps. An order has been placed for a further 25 public lighting lanterns with the Electrical Joint Box Co.

London.—St. Pancras.—The B.C. received the following tenders for 21 flame arc lamps :—Electrical Co., Ltd., (tender incomplete, carriers not included), £86 13s. 6d. ; Foster Arc Lamp and Engineering Co., Ltd., (could not supply sample lamp), £116 7s. 6d. ; Abbey Electric Co., Ltd., (no carriers included, tender incomplete), £165 ; Arc Lamps, Ltd., (Davy), (more substantial carrier, £60 extra), £183 8s. ; Gilbert Arc Lamp Co., Ltd., £184 ; Beck Flame Lamp Co., (the tenderers suggest that present carriers will be suitable, but this was not found to be so), £189 ; Maxim Lamp Works, Ltd., £210 ; Johnson & Phillips, Ltd., £213 ; Union Electric Co., Ltd. (Excello), (accepted), £216 11s. ; Crompton & Co., Ltd. (arbitration clause and penalty objected to), £222 ; Oliver & Co., Ltd. (includes Croydon Co.'s lowering gear ; if no gear price, then £220), £250 ; General Electric Co., Ltd., £300 ; British Westinghouse Co., Ltd., £308 ; Jandus Arc Lamp Co., Ltd., £315 9s. 6d. The chief electrical engineer, in reporting on the offers received, stated that he found the Excello, Crompton and Johnson & Phillips lamps the most suitable for the Council's purposes, and of these three he recommended the Excello lamp offered by the Union Electric Co., as the one which should be accepted, especially as this lamp had been in use outside the Council's showrooms for nearly four years with marked success. Moreover, the patent methods applied to this lamp for carrying away the products of combustion and keeping the globe clean had proved most advantageous.

The following tenders were received for an additional boiler at the King's Road generating station :—Edwin Danks & Co. (Oldbury), Ltd., (accepted), £2,600 (cost of re-erecting if required, £200), alternative, £2,400 (£49). Hawksley Wild & Co., Ltd., £3,081 (£70). Babcock & Wilcox, Ltd., £3,200 (£70). Clarke, Chapman & Co., Ltd., £3,260 (£100). In regard to Messrs. Danks and Co.'s boiler a communication had been received from Messrs. Babcock & Wilcox stating that, for the efficiency guaranteed, it was essential to adopt the system of baffling which is a subject matter of a patent of theirs for the type of boiler offered, and the firm considered it advisable to inform the Council that Messrs. Danks and Co., (London agents : the Water-Tube Boiler & Engineering Co.), had recently issued a publication copying their marine type boiler and embodying a patent of theirs, and they had accordingly entered an action against Messrs. Danks & Co. for infringement. Although Messrs. Danks denied this contention, the committee in charge of the matter considered it necessary that a satisfactory indemnity should be obtained from the firm. Messrs. Danks and Co. forwarded a form of indemnity which had been before the Law and Parliamentary Committee and which had been adopted by that Committee. As a further safeguard to the Council's interests the chief electrical engineer had suggested that 45 per cent. of the contract money should be retained until all patent rights were legally settled. Messrs. Danks & Co. had agreed to this.

L.C.C.—The L.C.C. received the following tenders for (*a*) 4,800 driving-wheel tires and (*b*) 1,600 pony-wheel tires for electric cars :—Phœnix Aktien-Gesellschaft für Bergbau & Hüttenbetrieb, Abteilung Ruhrort, Duisburg-Ruhrort, Germany (accepted for *a*), (*a*) £4,080, (*b*) £1,233 6s. 8d. ; John Batt & Co. (London), Ltd. (accepted for *b*), (*a*) £4,420, (*b*) £1,013 6s. 8d. ; Geo. Schultz & Co., (*a*) £4,520, (*b*) £1,026 13s. 4d. ; The Steel Company of Scotland, Ltd., (*a*) £4,800, (*b*) £1,200 ; Cammell, Laird & Co., Ltd., (*a*) £4,800, (*b*) £1,320 ; John Baker & Co. (Rotherham), Ltd., (*a*) £4,980, (*b*) £1,520 ; John Brown & Co., Ltd., (*a*) £5,100, (*b*) £1,560 ; Patent Shaft and Axletree Co., Ltd., (*a*) £5,160, (*b*) £1,506 13s. 4d. ; Hurst, Nelson & Co., Ltd., (*a*) £5,580, (*b*) £1,226 13s. 4d. ; Steel, Peech & Tozer, Ltd., (*a*) £5,400, (*b*) £1,533 6s. 8d. ; Fried. Krupp, Germany, (*a*) £5,760, (*b*) £1,600 ; Hy. Bessemer & Co., Ltd. (*a*) £6,000, (*b*) £1,600 ; Brown Bayley's Steel Works, Ltd., (*a*) £6,600, (*b*) £1,680 ; Samuel Fox & Co., Ltd., (*a*) £7,620 (*b*) £1,680 ; Vickers, Sons & Maxim, Ltd. (*a*) £10,080, (*b*) £2,400 ; Taylor Bros. & Co., Ltd., (*a*) £11,520, (*b*) £2,980.

Luton.—The T.C. has accepted the tender of Messrs. Clarke, Chapman & Co., Ltd., of Gateshead, for a water-tube boiler and superheater, with stoker, at £1,617.

Rotherham.—The Education Committee has accepted the tender of Messrs. Hall & Matthews for installing the electric light at South Grove schools, at £117.

Rugby.—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., for cable.

Southampton.—The T.C. has accepted the tender of Messrs. Willans & Robinson, at £392, for an air pump for a 300-KW. alternating set.

Uruguay.—The Government has accepted the tender of the Telefunken Co. for the installation of wireless telegraph stations along the coast, at various towns of the interior, and on the vessels forming the fleet.

West Ham.—The T.C. has placed an order with the British Thomson-Houston Co., at £83, for a Tirrill regulator ; it has also accepted the tender of the British Westinghouse Co. for switchgear, at £573.

Wrexham.—The T.C. has accepted the tender of the British Insulated and Helsby Cables, Ltd., for cables for mains extensions.

NOTES.

The Russian Electrical Trade.—The development of the electrical engineering firms in Russia is making progress, as a result, according to a St. Petersburg correspondent of the *Elektrotechnische Zeitschrift*, of the economic advance caused by the favourable harvest in 1909. Of course, various works still find sales to be inadequate, as they were established on too large a scale in relation to the total requirements of the country, and it can only be expected that they will gradually gain a market in accordance with their capacity of production when further new enterprises are created, particularly electric railways and lighting and power stations. The condition of the crops for the present year is also reported to be favourable, and if no failure takes place a further slowly progressing movement in the economic situation may be expected. It is, therefore, desirable, the correspondent remarks, not at present to erect new electrical manufacturing works in Russia, but, on the other hand, a negative attitude should not be adopted towards well-established undertakings capable of stimulating the demand by extensions, or to new enterprises which promise to be successful and remunerative under existing conditions. It is absolutely necessary in the matter to be in communication with persons who are acquainted with the local circumstances, and in whom the necessary confidence can be placed. Too much was expected of the future during the promoting period at the end of the last century, and the sales were not equivalent to the size of the various works. With the formation of new manufacturing undertakings, the business of those already in existence was somewhat increased, although agriculture, which is the principal consumer of industrial products, was not sufficiently capable of absorption. As a consequence the sales declined, and certain firms either disappeared wholly or were compelled to restrict their production. Many millions of marks of German money were lost, whilst the disadvantage for Russia was the discharge of many workers.

The St. Petersburg Strand Railway (Ssestroretzk) was taken over by the Crown four years ago, and is to be sold by auction in 1911. It is said, the correspondent observes, that an English syndicate is interesting itself in the matter, and proposes to introduce electric traction on the railway. A gratifying proposal has been made by the South Russian Co. to the Town Council of Rostow, on the Don, in the sense of offering to substitute on the outskirts of the town a new electricity works for the existing central station in the

middle of the town, and of reducing the prices for electrical energy if the contract is extended for 13 years. The Town Council considers the offer favourable, and has referred it to a committee for the conclusion of an agreement. Various other undertakings are in a similar situation. On the one hand, the towns after a short time will either come into possession of electricity works which no longer correspond with present technical requirements, and which will either develop very little, or not at all, up to the time of expiration of the concession, when purchase can be effected at scrap-iron prices and a new works be built; or, on the other, the towns will come into possession at a later date of modern works rapidly developing during the period of the concession, and yielding large net receipts. The latter proposal is considerably more advantageous to both parties. In such and similar cases, where the Town Councils or the State meet the undertakers and correspondingly favourable contracts can be concluded, it is naturally commendable to sanction the funds required for the installation.

The erection of electricity works at Tiflis is to receive closer consideration. Various schemes for the utilisation of water powers in the Caucasus for the purpose of electric railways, central stations, &c., are at present being prepared. As orderly conditions now prevail in the Caucasus, the general economic situation is improving, and the sale of electrical energy is growing. The German electrical industry and capitalists, the correspondent concludes, should devote attention to this situation, provided that remunerative enterprises are in question.

The Fragility of Metal-Filament Lamps.—Although the many improvements in the manufacture of metal-filament lamps that have been brought about during the past two years have resulted in increased life and efficiency under normal conditions, the fragility of the filaments employed is still a serious matter. Were it not for the fact that the lamps are unable to withstand rough usage, they would be adopted to a much greater extent in mills and factories than they are at present. In such situations not only are the lamps subject to excessive vibration, but as the ceiling from which they are suspended is usually a floor also, the moving or dropping of heavy weights causes jars or shocks that are destructive to the filaments in spite of the flexibility of the suspension.

Attempts have been made to overcome this drawback by a spring suspension of the filament. Instead of the filament being coupled rigidly to the leading-in wires of the lamp, it is connected through a spiral and thus given a flexible mounting. But in connection with this it must be remembered that shocks can be communicated to the filaments by other means, and so the method adopted will probably only reduce the percentage of breakages somewhat and not do away with the trouble altogether. Moreover, the mass of the filament is so minute, that unless the spiral is formed of the filament itself it is sure to be too stiff to be of service in shielding the filament from shock.

From time to time spring-suspension devices have been introduced; but, generally speaking, these have not met with the anticipated measure of success. Under certain conditions the springs, which are an essential part of the appliance, are prone to vibrate in unison with some other vibration, and so accentuate the trouble they were designed to overcome.

The transmission of outside vibrations to the filament is prevented to a large extent, if not altogether, by a Continental method of manufacture. The foot of the lamp carries a rod arranged axially, which is surrounded concentrically by a cylindrical part, which forms the filament-holding device. The connection between this latter and the centre rod is formed by springs so arranged that all vibration along the rod is taken up before the filament supports are reached. In one form the elastic connection is by means of carefully-tensioned hair-springs, whilst in the most improved form the filament support is held concentrically with the centre rod by means of one spring, and is slung on two other springs arranged as part of the leading-in wires, which successfully prevent any vibration of the lamp being transmitted to the filament. There appears to be some hesitation amongst British makers of metal-filament lamps as to introducing any anti-vibratory device into the construction of their lamps; but there is little doubt that if some satisfactory means of taking up vibration could be introduced it would go far towards still further increasing the popularity of the metal-filament lamp.

A New Electro-Metallurgical Plant.—Electro-metallurgy has not advanced in this country as rapidly as it has done on the Continent and in America. It is usually understood that this slow growth is due to lack of water power in England, an argument which cannot be sustained in the light of recent progress. The latest development of the electric steel trade has taken place in America under the direction of the United States Steel Corporation, and it is interesting to note that the necessary energy is produced entirely from furnace gases. Two 15-ton Héroult furnaces have been installed, one at the South Chicago works, and the other at the Washburn and Moen works. The functions of these differ somewhat. In the one case molten metal from the Bessemer converter is refined up to the open-hearth standard, but at reduced cost, while in the other basic open-hearth metal is further refined to produce a very high-grade steel at slightly increased cost. The South Chicago plant is the more interesting, and has been in operation since May of last year. In this case the product of the Bessemer converter requires to be both desulphurised and dephosphorised, operations which are carried out very uniformly in a time varying from 1½ to 2 hours, the energy consumption being from 40 to 100 KW.-hours per ton of metal refined. This plant runs continuously six days of 24 hours per week, the current being shut off only for charging and repairing operations. On an average 12 heats are made per day. As already stated, the power is developed from blast-furnace gases, and is charged for at the rate of ¼d. per KW.-hour. Cost of repairing is proportionally low, and averages about 6d. per ton of refined metal. The consumption of electrodes is about 6 lb. per ton of steel. The temperature on discharging is 1,500° C., but this drops to 200° C. in 15 minutes, when repairs to the furnace linings can be completed and recharging commenced. Each furnace requires four attendants, and an extra hand during tapping operations. The finished product contains 0·45 per cent. carbon, 0·03 per cent. sulphur, 0·03 per cent. phosphorus, and tests as follows:—Elastic limit, 35,000 to 47,000; tensile strength, 60,000 to 70,000; elongation, 25-30 per cent.; reduction of area, 43 to 60 per cent.

Parliamentary.—The following Bills received the Royal Assent last week:—

Wemyss Tramways (Extensions) Order Confirmation Act, 1910.
Electric Lighting Orders Confirmation (No. 3) Act, 1910.
Bishop's Stortford, Harlow and Epping Gas and Electricity Act, 1910.
Yorkshire Electric Power Act, 1910.
Reading and District Electric Supply Act, 1910.
London Electric Railway Amalgamation Act, 1910.
Metropoljtan Railway Act, 1910.
Belfast Corporation (Tramways) Act, 1910.
Wimbledon and Sutton Railway Act, 1910.
Baker Street and Waterloo Railway Act, 1910.

On Thursday last week, in the House of Lords, the London County Council (Tramways and Improvements) Bill was read a third time, and passed.

Inquiries for the U.S.A.—The *Electrical World* states that Mr. C. M. Shaw, city electrical engineer of Worcester, is to pay a visit to the United States in August and September, and asks manufacturers to send him particulars of "up-to-date turbine plants and umbrella-type alternators," for a head of 10-13 ft. and of 150-600 H.P., as well as of the latest domestic electrical appliances (not for lighting). The probability that Mr. Shaw will place a large order with our American competitors should prove a valuable stimulus to their jaded energies, and afford them an opportunity of renewing that invasion which for some reason or other seems to have lain in abeyance for the last decade. It is time for England to wake up!

Unwarranted Meddling.—The following remarkable statement has come to hand too late for inclusion in our "Correspondence" columns:—

"Electrical engineers whose Councils are considering the lighting of their streets by metallic-filament lamps, or who at present use this means of lighting, are warned that recently a gas company in London was found to temporarily remove the lamps from columns during lighting hours, their object in doing so being stated to be 'for testing.'

"In view of the fragile character of the metallic-filament lamp, it cannot be stated to be just competition to tamper with such apparatus; moreover, the fact that all tests as to efficiency of lighting can be carried out without interfering with the source of light, whether it is gas or electric, renders such an action unjustifiable.

"Although one cannot but admire the persistence with which the gas companies are waging a hopeless warfare in endeavouring to recapture street lighting, I think they have overstepped the bounds of commercial morality, and have at the same time committed a breach of the law.—Yours faithfully, STATION ENGINEER."

If our correspondent's information is correct, the gas company has been guilty of an act which is not only grossly impertinent, but highly reprehensible. It is impossible to conceive of any reasonable excuse for such an act.

The Aluminium Market.—The shares of the Aluminium Industry Co., of Neuhausen, experienced a large fall on the Frankfort Exchange on July 26th, and the decline was sought to be associated with announcements variously made of a weakening in the price of aluminium. It is mentioned by a Frankfort newspaper in this connection that the demand for the metal has abated somewhat recently, and the quieter course of business has induced merchants to reduce their quotations. Although, as a result of these offers, the price amounts at present to about 72s. 6d. per cwt., as compared with the highest rate this year of 77s. 6d., the situation of the market is described in trade circles as not being weak, as producers are not more yielding. This is also shown, it is added, by the almost unchanged price of £73 to £75 per ton charged by the British Aluminium Co.

Cricket.—A team representing the Cambridge Electric Supply Co. met the Regent in the second round of the Cambridge Junior Cup competition at Cambridge on Saturday. The Regent won very easily, the scores being: Regent, 102 for eight wickets: Electric Supply Co., 68.

Smoke Abatement.—The Smoke Abatement Exhibition promoted by the Corporation of Glasgow is to be opened next month. Floor spaces, varying in area from 70 to 500 sq. ft., have been let to about 50 exhibitors from all parts of the country. The electricity departments of Glasgow Corporation will provide interesting exhibits, and a house will be fitted up entirely heated and lighted by electricity. All kinds of electric cookers, heaters

and lighting appliances will be shown; exhibitors are invited to make a good show, and the Corporation supplies the electrical energy required for stands free of charge.

Inquiry.—Makers or suppliers of carborundum cloth are asked for.

Institution and Lecture Notes.—British Medical Association.—Dr. Louis Wickham, of Paris, on July 28th gave an account of his researches and experience in the treatment of cancer by radium. More than 600 cases have been treated by him, and he has come to the conclusion that if radium must not be considered as a regular cure of cancer, it can be of real service to those suffering from this disease. In certain malignant cases, he has been able to obtain an almost complete regression; this regression is local. The best and most rapid results are obtained by combining radium with surgery.

Institution of Mechanical Engineers.—On Friday last the Institution entertained at dinner the visiting members of the American Society of Mechanical Engineers, Mr. J. A. F. Aspinall, the president, being in the chair.

The visit of the German Association of Gas and Water Engineers to Great Britain, which was postponed on account of the death of King Edward, has now been arranged to take place during the week commencing October 2nd next. The visitors are to be the guests of the Institution of Gas Engineers, and several of the leading gas companies.

Tug-of-War.—On Saturday last, in a 90-stone open tug-of-war in the Amateur Athletic Association's Sports at Herne Hill, the Central London Railway Power House team were the winners; nine teams entered, and the winning team defeated Hither Green Sidings by 2 to 1; Coldstream Guards, 2 to 0; and R. W. Blackwell & Co., 2 to 1. The strong men from the Power House were Messrs. Laidlaw, Connett, Hughes, Tyson, Jenner, Ford, Rumble, Orme, and Forgan (captain, and power house superintendent), each of whom received a gold metal. The team was afterwards entertained at dinner at Frascati's by the A.A.A., together with the cycling champions, and spent an enjoyable evening. The C.L.R. Power House team possesses the unique record of having won not only the first A.A.A. Championship, but also the first open *Evening News* Championship (in 1908).

Fire.—A fire involving the loss of five lives occurred in a drapery store at Accrington on Saturday night, the cause, it is alleged, being the fusing of an electric wire in a show window containing highly inflammable goods. Apparently the flexible by which a lamp was suspended short-circuited and caught fire, and although the manager attempted to extinguish it, burning his hand badly in the endeavour, some lace was ignited and the fire spread with extraordinary rapidity. In view of the deplorable disaster at Messrs. Arding & Hobbs's shop last Christmas precautions should have been taken in all show-windows similarly situated, but apparently nothing short of compulsion will ensure the provision of the necessary safeguards.

Appointments Vacant.—Patent Office: Assistant examiners are to be appointed; junior assistant engineers, for the Newcastle-upon-Tyne Electric Supply Co., Ltd.; junior shift engineer, for the Bexley Council Tramways (27s. 6d.); shift engineer for the Buxton U.D.C. Electricity Department (30s.); see our advertisement pages in this issue. Assistant lecturers in mechanical and electrical engineering are to be appointed at the Blackburn Technical School.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The chief officers of the Kettering U.D.C. have presented a Sheraton timepiece to Mr. W. A. Walker, electrical engineer, on his marriage.

At Stafford Town Council meeting on Friday it was proposed, on the recommendation of the Electricity Committee, to increase the salary of Mr. R. E. Meade, resident electrical engineer, from £175 to £200 per annum. The recommendation was, however, lost.

The Epsom U.D.C. has increased the salary of the electrical engineer, Mr. Gilling, from £200 to £210 per annum.

Mr. Knorr, charge engineer at the Bexley U.D.C. electricity works, has relinquished his position.

The Stoke-on-Trent Council has decided that Mr. C. H. Yeaman shall commence his duties as chief electrical engineer of the borough on September 1st, and that three months' notice shall be given to the present electrical engineers of the Burslem, Longton and Stoke works to terminate their engagements.

Mr. W. A. Tester, engineer to the Lancaster T.C., has applied for leave of absence for 12 months in order that he may proceed to a temporary appointment in Johannesburg. The Committee has agreed to it on condition that an efficient engineer is obtained during the period Mr. Tester is absent from Lancaster.

General.—The Birmingham T.C. has confirmed the appointment of Mr Howard Foulds as secretary to the electricity supply department, at a salary of £600 per annum.

The Barnsley T.C. has appointed Mr. T. W. Sampson as instructor in electrical engineering and wiring, and Mr. H. Matthews as instructor in electric wiremen's work, at the Technical Institute.

The wedding was solemnised at the Accrington Primitive Methodist Church last week of Miss Jessie Holmes, second daughter of Mr. Herbert Holmes, of Abbey Street, and Mr. Herbert H Garnett, electrical engineer, of Morecambe.

The marriage took place at Pendlebury on July 27th of Mr. Edward Lionel Castle, chief electrician at Messrs. Matthews and Yates's Cyclone Works, Swinton, and Miss Maud Edith Lomax, only daughter of Mr. Wm. Lomax, of Pendlebury. The presents included a set of bronzes and fish carvers and silver cigarette and pencil case from the firm, staff and employés of Messrs. Matthews and Yates, and a rose bowl from the workpeople of the Electric Winding Co., Pendlebury.

According to the *Times*, after two years' friction and several months' open conflict, Mr. George Westinghouse has been deposed by the directors from the presidency of the Westinghouse Electric and Manufacturing Co., of which he was the founder, and over which for 25 years he has been the autocratic head. Mr. Edwin F. Atkins has been elected in his stead.

Mr. George G. L. Preece, for 15 years with Messrs. W. T. Glover & Co., Ltd., electric cable manufacturers, Trafford Park, Manchester, and for the last few years acting as their technical and special outside cable expert, has now joined the firm of Messrs. Bruce Peebles & Co., Ltd., of Edinburgh.

Mr. Edward Bowden, who had a distinguished career at Armstrong College, Newcastle-on-Tyne, has been awarded by the Royal Commissioners for the Exhibition of 1851, a science research scholarship of £150 a year for at least two years, with which he is to proceed to Carlsruhe. Mr. Bowden has lately been associated with Prof. Thornton, of Armstrong College, Newcastle-on-Tyne, in conducting numerous experiments bearing on the ignition of coal dust by single electric flashes.

Mr. R. B. Leach, consulting engineer to the Farnworth Council, has been engaged by the Turton U.D.C., Lancashire, to advise upon and design a bulk-supply electric lighting scheme, &c., for the Turton area, as the Turton Council now contemplates moving forward with its Provisional Order.

Mr. Jas. R. Wilkinson, son of Mr. Geo. Wilkinson, borough electrical engineer, Harrogate, has finished his course at University College, London, by obtaining the college diploma in engineering "with distinction," and winning three prizes. He has also obtained the London degree of B.Sc. in the 2nd class honours division. During the college course Mr. Wilkinson has been a member of the officers' training corps, and he has obtained a commission in the special army reserve of officers.

Obituary.—On Saturday last the remains of Mr. George Flett were interred at Weybridge Cemetery, in the presence of relatives and many friends. At the same hour a memorial service was held in the church of St. Mary Abchurch, Abchurch Yard, which adjoins the head offices of Messrs. Dick, Kerr & Co., Ltd., and was attended by a large number of the staff and of Mr. Flett's friends. Mr. Flett was born at Wick in 1855, and was educated in Glasgow, whence he migrated to London, entering the employment of Messrs. Dick, Kerr & Co., Ltd., 28 years ago. He was mainly occupied in tramway contracts in the earlier part of his career, being successively interested in horse, cable and electrical tramway undertakings. Latterly, however, he was more intimately associated with the manufacturing side of the business of the firm, which embraces a large field of electrical engineering, and has carried through many undertakings of the first magnitude. One of the most notable of these was the equipment of the Liverpool-Southport section of the Lancashire and Yorkshire Railway, the great success of which is a matter of common knowledge; many important contracts in connection with British and foreign tramway and railway undertakings also passed through his hands. Some of these entailed journeys to various parts of the world, and Mr. Flett's wide knowledge of affairs led to his association with many important schemes abroad, as well as at home, especially in the Far East. Besides being the managing director of Messrs. Dick, Kerr & Co., Ltd., he was a director of the Metropolitan Amalgamated Railway Carriage and Wagon Co., Ltd., the Patent Shaft and Axletree Co., Ltd., the Projectile Co., British Aluminium Co., Ltd., Rio de Janeiro Tramway, Light and Power Co., Mexican Light and Power Co., Ltd., Monterey Light and Power Co., and the British Engineering Co., of Egypt. Apart from his business relations, his geniality and camaraderie rendered him highly popular amongst his associates, upon whom his sudden death has fallen as a personal calamity of the most distressing nature, and who will ever mourn the loss of a true friend and an honourable colleague. His energy was boundless, and his enthusiasm contagious, infecting all those who assisted him in his enterprises. Of commanding and distinguished presence, he was generous to a degree, fair and just in all his dealings, exercised an important influence in the electrical industry, and was always absorbed in matters for its improvement, although he steadfastly refused to fall into line with those "reformers" who had axes of their own to grind. His favourite relaxation was yachting, and he owned one of the finest schooners in the country. His magnetic personality placed him amongst the great captains of industry, and he will be greatly missed in financial, commercial, social and engineering circles.

CITY NOTES.

London, Brighton and South Coast Railway.

The Earl of Bessborough presiding at the hundred and twenty ninth ordinary meeting on Wednesday, in moving the adoption of the report, said that both passenger and goods receipts had increased substantially, and it was especially satisfactory to see that the number of passengers, exclusive of season ticket holders, had increased by over two millions. Locomotive power expenses showed an increase of £9,092, but the item comprised both steam and electric working, and the increase might be attributed to the cost of electrical energy. The institution of electrical working, particularly on the system they had adopted, was admittedly a big experiment. It was not thought advisable to embark any of their own capital in erecting a generating station, and they therefore made arrangements with the London Electric Supply Corporation for the supply of energy. At first only a small quantity was required, and without experience on either side it was difficult to arrange a very close contract, but now it had been decided to extend the system, they had been able to revise the arrangement upon a very favourable basis, the working of which would produce a substantial decrease in the cost of current. Reference was made in the report to the continued success of the electrical train services on the South London Railway, and it was stated that a further portion of the suburban railways was now in course of equipment for electrical working. He told them in February of the large increase in the number of passengers which had taken place even at that early stage of the South London services, and he was glad to say now that that progress had been uninterrupted, whilst there was still nothing but praise for the system from the mechanical point of view. It was a little early to say much about the comparative cost of electrical and steam working, but he had already told them of the beneficial arrangement they had made with regard to the very important item of current, and so far as could be foreseen there was nothing else likely to throw any extraordinary expense upon them. In these circumstances the board felt sure the proprietors would endorse its decision to extend the system. The present scheme consisted of the equipment of the railway from Peckham Rye, where a junction was made with the South London Railway, through Tulse Hill to the Crystal Palace, and from Battersea Park, where the South London Railway was joined again, through Clapham Junction, Balham and Streatham Hill to West Norwood, where the first-mentioned line was met. These lines formed a very important part of the company's suburban system and served some of its most populous districts, most of which were intersected by the London County Council tramways. The improved services which electrification would make possible could not fail not only to bring back to the railway some of the traffic which had gone to the trams, but to be of general benefit to the districts and in all probability to produce entirely new business. Moreover, the scheme would be of considerable advantage to that famous institution the Crystal Palace, and the board had special regard to it at this moment because of urgent representations for improved services which had been made by the promoters of the Imperial Pageant. It was proposed to produce the Pageant at the Crystal Palace in the spring of next year, and the contracts for the railway works were fixed to be completed by that time.

Mr. C. Colin Macrae seconded the motion.

Mr. Dingwell said it was satisfactory that the electrical installation had proved such a success, especially as on one or two occasions in that room a little doubt had been expressed as to whether it would prove a success. It certainly seemed to show that it was possible to fight tramway competition and recover the passengers which had been lost, and that also seemed to have been proved by the experience of the North-Eastern Railway.

The report was adopted without further discussion.

Anglo-American Telegraph Co., Ltd.

The half-yearly meeting of this company was held on Friday of last week, at Winchester House, Old Broad Street, Mr. Robert H. Benson presiding.

The Chairman, in moving the adoption of the report (see page 186) said he was sure they would all be sorry to hear that Mr. F. A. Bevan was too unwell to be present to take the chair at that meeting. They had also to regret the absence through ill-health of Sir Charles Burt. Turning to the report it would be seen that in round figures their traffic receipts showed an increase of £7,000, and as the earnings of the ss. *Minia* were £10,300 less than the corresponding period, there was a net decrease of £2,810. The renewals fund now stood at £967,496, as compared with £954,854, and would have been more but for the heavy repairs in the "1874" cable. He would like, in view of recent events, to recapitulate the strategic position of the Atlantic cables. There were 16 cables laid between Europe and America controlled by four different parties. Seven of the 16 cables, including 14 which they owned, were in partnership for the purpose of mutual assistance and better service to the public. One of their partners was the Direct Co., who owned one cable and the Western Union, who possessed two cables, and had besides 140,000 miles of land cable in North America. The Commercial Co., who owned five cables, had 330,000 land miles, which reached most important cities, and controlled the Postal Telegraph Co. In England, as they were aware, the land cables were the property of the Government, who distributed its favours impartially to all parties. In America, however, the cables were owned by private enterprise, and in addition to the Western Union and Postal Companies, which were telegraph companies only, there had grown up a still more powerful company—the American Telephone and Telegraph Co., with over £100,000,000 capital, and which paid 8 per cent. on some £50,000,000 or £60,000,000 of ordinary capital. Last winter this concern became financially interested in one of their partners—the Western Union. It happened that the chairman of the American Telephone Co. was over in this country in May, and they were glad of the opportunity to make his acquaintance, not only because he pursued the same kind of business, but because of the ability he showed in the directing of his own affairs. While he was here that gentleman gave an order for the laying of another cable in the Atlantic, and they were glad to find that it was done with no idea of introducing competition into the ocean business, and, in fact, the order given by the chairman of the Telephone Co. was given with the intention of using it on behalf of the Western Union, and in anticipation of their coming to terms. A table would be shortly issued by the company showing the progress of the undertaking during the past 14 years. It would show that whilst in 1896—a year of extreme depression—the total revenue was £324,899 and £185,500 net; last year it was £426,753 and £255,644 net. Though that increase was encouraging, the expenses had increased in greater ratio, and although their staff transmitted last year some 24 per cent. more traffic than in 1908, and during the past six months under review 40 per cent. more than the corresponding period last year, they had not, nor had their partners, the Western Union and the Direct Companies got as large a profit as they thought they were entitled to, seeing the growth in the total cable traffic. It was possible if they succeeded in indentifying themselves with the American Telephone Co. that they might participate more largely henceforward in the growth of the cable business. The board were unanimous in desiring an agreement on the basis of not jeopardising the dividends and of securing a fair share of whatever increase in the cable business the arrangements might bring about. They also wanted more unanimity of management—complete harmony of the component parts in the organic whole. If they gave the public better facilities, he had no doubt they would respond by giving them more messages to carry. They had arrived at an agreement with the American Co. on principle, but the details has yet to be settled. There remained a lot to be done. Their agreement with the Western Union and the Direct Co. had to run another 10 years, and it could not be modified without the consent of everybody concerned. If they succeeded in carrying this to an agreement, it would immediately be put in print and submitted to the shareholders.

Mr. Leon seconded the motion.

Mr. J. D. Santilhano, who spoke for a number of shareholders in Holland, remarked that they were aware that this question of association with the American Telephone Co. was an important one. They were strongly in favour of this fusion of interests, and a closer combination between the Anglo-American and other companies. The result of such negotiations, if they should prove successful, must mean greater economy in management, and better facilities for the public. He would like to say one word in regard to their reserves, and that was that they should not be in any way affected by this scheme, and they would thus be able to financially strengthen the position of the company.

The Chairman, in reply to the shareholders' remarks, said they were endeavouring to settle the future destinies of the company, not merely for 10 years, which was the length of their agreement with the Direct and the Western Union Companies, but for perpetuity.

The report was adopted.

Blackpool and Fleetwood Tramroad Co.—The directors announce that for the half-year there is an available balance of £5,278 for distribution. Of this amount, they propose to put £750 to depreciation reserve, and £500 to the general reserve. A dividend at the rate of 4 per cent. (the same rate as last year), which will absorb £3,000, is recommended. The balance carried forward to current half-year is £1,028.

Vickers, Sons & Maxim, Ltd.—The following interim dividends for the half-year ended June 30th last will be paid to the holders of the stock and shares of the company who are registered on August 6th; 2½ per cent. (less income-tax) on the preferred 5 per cent. stock and 5 per cent. preference shares; 1s. per share (free of income-tax) on the ordinary shares. The same dividends were paid last year.

Brompton and Kensington Electricity Supply Co., Ltd.—Interim dividend for the half-year to June 30th at the rate of 9 per cent. per annum, being the same rate as last year.

Stock Exchange Notice.—The Committee has ordered the following to be quoted in the Official List:—British Westinghouse Electric and Manufacturing Co., Ltd.—Further issue of 100,000 10 per cent. preference shares of £3 each, fully paid (Nos. 475,001 to 575,000); and £225,000 4 per cent. mortgage debenture stock.

Lancashire Power Construction Co., Ltd.

The directors' report to December 31st, 1909, says that this company, as the holder of all the shares of the Parliamentary Co., depends for its revenue on the profits of the latter company. Although the Parliamentary Co. has made considerable progress during the 12 months under review, it is not yet in a position to pay a dividend on its capital. It has, however, reached the state of being self-supporting, so far as receipts and expenditure on its trading account are concerned. This result has been attained in spite of general bad trade in the district, and especially of the unsatisfactory state of the cotton trade, in which short time was worked during the last six months of 1909, thus materially reducing the consumption of electricity in the mills and other factories supplied by the company. Notwithstanding these adverse conditions, the receipts during 1909 have largely increased, and the position generally has been materally improved. It is satisfactory to note that this improvement continues, as the returns for the first three months of 1910 indicate a trading profit which is estimated to be at the rate of £5,000 per annum. The rate of growth of the Parliamentary Co. is shown in the following figures :—

	1906.	1907.	1908.	1909.
Units generated ...	4,174,745	6,913,910	7,171,793	9,251,831
Max. load, KW. ...	2,060	2,330	2,890	3,820
H.P. connected ...	3,280	4,342	5,960	7,710
Receipts	£5,299	£9,250	£10,056	£15,294
Expenditure ...	£9,182	£13,722	£14,421	£15,164

It will be observed that the receipts for the past year have increased by over 50 per cent., as compared with those of 1908, while the expenditure has advanced by only 5 per cent., the principal factors responsible for this improvement being the considerable increase in output, a favourable coal contract, and economies at the power station. During the year the electric lighting orders obtained by the following local authorities were transferred to the Parliamentary Co., namely :—Abram Urban, Aspull Urban, Barton Rural, Bury Rural, Kearsley Urban, Little Hulton Urban, Little Lever Urban, Ramsbottom Urban, Tyldesley Urban, Westhoughton Urban, Whitefield Urban, Worsley Urban. Low-tension distributing systems have already been put into operation in Westhoughton and Walkden, while work is in progress to enable a supply to be given in Ramsbottom and Whitefield. The use of the Parliamentary Co.'s supply in the colliery districts is now expanding rapidly, several large collieries having been connected to the mains, or contracted for during the year. Only a small proportion of the anticipated supply has yet been taken by these companies, and their advantage as new customers will only be felt in this and the following years. As mentioned in last year's report, the directors, in their capacity as the board of the Parliamentary Co., have used every endeavour to come to an agreement with the Radcliffe Council, relative to the supply of electricity to large power users in that district, whom the Council themselves cannot supply, owing to the limited capacity of their works, but without result. An application was therefore made by this company to the Board of Trade under the Electric Lighting Acts for a provisional order to supply electricity in Radcliffe, and although the Board have decided not at present to grant an order to this company, they have intimated that if the company makes a similar application at a future date, and is able to show that the conditions have not materially changed, they will be prepared to reconsider their present decision. Mr. H. C. Levis, managing director of the British Thomson-Houston Co., has been elected to the board in place of Mr. Carolan. Messrs. F. E. Gripper and Sir Robert A. Hampson are the retiring directors.

Lancashire Electric Power Co.

The annual meeting of this company and its affiliated company the Lancashire Power Construction Co., Ltd., was held on Thursday last week at Salisbury House, London Wall, Mr. H. F. Parshall presiding.

The Chairman, in proposing the adoption of the report, said the business of the Parliamentary Co. had progressed so that it was reasonable to estimate the present rate of trading profit at £5,000 per annum. As regarded the growth of connected load during the year, he thought this might be taken as fairly satisfactory, having regard to the general conditions obtaining in the Lancashire district. The growth during the year had been 1,750 H.P., or at the rate of 150 H.P. per month. The average size of customer was about 200 H.P. The bulk of this business had been done with the cotton industry, and this despite the depressing conditions obtaining in the cotton trade. As regarded the prospect of growth, the load actually contracted for, but not connected, was some 1,800 H.P., which was greater than the entire growth of last year. It was expected that the whole of this load would be connected and become a source of revenue before the end of the present year. This new load was largely in connection with the coal mining industry. In addition to this, there was the usual growth to be anticipated in connection with other classes of work. There was also a certain amount of growth to be expected in connection with the orders taken over from the different local authorities. This business was not large in volume, but the amount of capital required was not considerable; the return per unit, however, was higher than in most classes of industry. It was satisfactory to note that during the year the price per unit had continued to increase. This was due to certain readjustments in connection with existing contracts, and to improved prices in the general class of supply. During the year £13,115 had been invested in the Parliamentary Co. Of this amount £9,315 had been spent on distribution to supply the 1,300 H.P. increase of load at the station, which not only provided for this increase of load, but also for any reasonable demand that might arise in the district served. £3,000 had been spent on the power house, which had resulted in an increase in the working capacity and efficiency of the generating plant. The coal consumption for the first half-year of 1910 had been at the rate of 3·35 lb. per high-tension unit generated, which showed an improvement of some 20 per cent. on the results over the corresponding period of 1909. Under the present working conditions the load factor at the power house was some 30 per cent. The power house, however, was but half loaded. The above figure indicated a high degree of efficiency not only in the generating plant, but also in regard to the operating staff. The importance of economy in coal consumption would be realised when he stated that the cost of coal was about 50 per cent. of the cost of the delivered unit. Several local authorities applied for powers to supply in the authorised area of the Parliamentary Co., and the directors felt that if they allowed such encroachments the value of the undertaking would be jeopardised. As a result, the company obtained the protection sought, after taking the case to the House of Lords. The result of this had been that in the Bills promoted in the present session, the local authorities had, in each case, undertaken not to supply in the area of the Lancashire Power Co. without the consent of that company. Owing to the general position taken up by the Radcliffe Council, as also the report of the Local Government Board, with respect to the extension of their electricity undertaking, having regard to the supply offered by the Lancashire Co., the directors of the company felt warranted in promoting an Electric Lighting Order to give three-phase supply to the class of customer that could not be supplied by the Radcliffe Council. The directors felt strengthened in their decision, in that the attitude of Parliament, as it had been generally understood, was that whenever a local authority was unable or unwilling to give a suitable supply, they should not prevent such supply being given from an external source. In the case of Radcliffe the supply was different and unsuitable for the supply to large consumers within their district, their undertaking being altogether too small to give an efficient supply to the class of customer for which the Lancashire Power Co. sought powers. While beyond question of doubt the Lancashire Co. established their case, the Board of Trade for the time being had not granted the order to the company, but had intimated to the Radcliffe Council that unless there was a general change of position, a further application by the company for such an order might be granted. In the face of this intimation the company had hopes of entering into more satisfactory relations with the Radcliffe Council during the year. The importance of Radcliffe to the Lancashire Co. would be apparent when he stated that the amount of power in the district immediately surrounding their power house exceeded by 100 per cent. their total connected load. Most of the proprietors employing this power petitioned for an electric supply from the Lancashire Co. when the application was made to the Board of Trade.

Sir Robert A. Hampson, in seconding the motion, remarked that it must be a matter of satisfaction to those interested in the concern, that not one, but several factors, had contributed to the results of the year's operations—increased business, increased economy and efficiency, and improved prices. He had only to add that their relations with the Board of Trade and the local authorities were all that could be desired.

The report was adopted.

German Telephone Trade.—It has been reported tha the Telephone Works (Berliner) Co., of Hanover and Vienna, proposed to amalgamate with the C. Lorenz Telephone and Telegraph Works Co., of Berlin, which was formed in 1906, and has a share capital of £70,000. It turns out, however, that it is only intended to form a community of interests between the two firms, as a group associated with the Berliner Co. is endeavouring to secure a majority of the shares in the other company in question.

National Gas Engine Co., Ltd.—An interim dividend of 5½ per cent. per annum, less income-tax, on preference shares, and 20 per cent. per annum, less income-tax, on ordinary shares for the six months ended June 30th, 1910, has been declared. The dividend on the new shares is calculated from March 1st, or from date of payment of call if paid since that date.

Continental.—Russia.—La Société Russe des Accumulateurs Tudor, of St. Petersburg, reports a net profit of 220,268 roubles for the past financial year; a dividend at the rate of 12 per cent. is being declared, as compared with 10 per cent. in the preceding 12 months.

Germany.—The balance-sheet of Kortings Electricitätswerk Gesellschaft, of Berlin, for the last financial year, shows a net profit of £12,619, as contrasted with only £10,886 in the preceding 12 months. The dividend is being increased from 6½ to 7 per cent.

Spain.—La Compagnie Générale Madrilene d'Electricité, of Madrid, reports a net profit of £36,927 for the last financial year; a dividend at the rate of 6 per cent. is being declared.

Hove Electric Lighting Co., Ltd.—An interim dividend on the ordinary shares at the rate of 8 per cent. per annum, payable on October 15th next, has been declared; full interim dividend on the preference shares, due on September 1st next, at the rate of 5 per cent. per annum, for the same period, is also to be paid.

Central London Railway Co.

The report of the directors for the half-year ending June 30th, 1910, shows traffic receipts amounting to £146,586, being an increase of £2,927; miscellaneous receipts, £11,753, an increase of £1,670; making the gross receipts £158,339, or an increase of £4,597 over 1909. The working expenses amounted to £87,628, a decrease of £1,974, leaving a balance of £70,711, or £6,571 more than in 1909. After providing for interest on the debenture stock, and other payments, there remains a sum of £85,079.

The directors recommend dividends on the undivided ordinary stock at the rate of 3 per cent. per annum for the half-year; and on the preferred ordinary stock at the rate of 4 per cent. per annum for the half-year, absorbing £39,273, and the dividend on the deferred ordinary stock not being payable until the result of the full year's working is ascertained, the balance of £45,805 is carried forward to next half-year.

The number of passengers carried in the last three years, including those using through tickets and the cheap return tickets issued before 7.30 a.m., is as follows:—

Year.	Half-year ending June.	Half-year ending December.	Total.
1908..	19,901,750	21,996,623	41,898,373
1909..	18,989,109	19,394,285	38,383,394
1910..	20,664,896	—	20,664,896

During the period of public mourning, after the death of the late King, the ordinary business of the company was appreciably decreased, and the attendance at the Japan-British Exhibition, which opened on May 14th last, was also lessened. Notwithstanding these drawbacks, it will be seen from the above table that 1,675,787 more passengers were carried last half-year than in the June half-year of 1909, and as compared with the same period of 1908 (the year of the Franco-British Exhibition) there is an increase of 763,146 passengers. A contract has been entered into for the construction of the extension of the Central London line from the Bank Station to the Liverpool Street Station of the Great Eastern Co., with a connection to the Broad Street Station of the London and North-Western and North London Companies, as authorised by the Act of 1909, and work has practically commenced. This extension, when completed, will provide a convenient exchange for passengers to and from these stations, and it is anticipated that a very considerable accession of traffic will result. A contract has also been let for the making of the public subway between the Bank Station of the Central London Railway and the booking hall of the City and South London Co. in King William Street, the cost of which will be borne equally by the two companies. At the conclusion of the ordinary general meeting, an extraordinary general meeting will be held to sanction the creation of the additional capital authorised by the Acts of 1902 and 1909, amounting together to £480,000, in the form of 4½ per cent. preference stock, and the exercise of the relative borrowing powers amounting in the aggregate to £160,000. It is estimated that a sum of £300,000 will be required for the new works referred to above, the balance of the amount created remaining available for further capital purposes as may be required from time to time. The directors record with deep regret the death of their late colleague, Mr. Henry Tennant, who was the first chairman of the Central London Railway from 1895-8, and who retired from the board in February, 1909.

National Telephone Co., Ltd.

The forty-sixth ordinary general meeting of the shareholders of the above company was held on Friday last at Hamilton House, Victoria Embankment, Mr. George Franklin presiding.

The Chairman, in proposing the adoption of the report (see page 145), said there was a large increase of between £30,000 and £40,000 in the maintenance and renewal of plant, and that large increase in maintenance might be accepted as an indication of the company's determination, even at a present sacrifice, to maintain at a high point of efficiency the company's plant and system. That policy had the advantage of enabling the Postmaster-General to acquire not merely the fine organisation and the efficient staff which he would get for nothing, but a plant and equipment fully maintained, and in sound working condition, for which the company would require payment. The shareholders would reap their advantage in the price to be received for the plant and apparatus that was maintained in the later years of the license at concert pitch. The reserve fund for the half-year would amount to no less a sum than £3,705,127. He had often explained to them that that was the sum which was set aside as an insurance to provide for any possible diminution there might be in the company's capital, as a result of the valuation to be placed upon the assets upon the sale to the Postmaster-General. The question of the amount and the price to be obtained might be diminished by reason of that large provision, and it must be satisfactory to the shareholders to be, as far as possible, secured against contingencies. None of them could tell what would result from the steps which were being taken to have a value put upon the plant, and no one could tell what would be the price, or anything near the price, which the Postmaster-General might be expected to pay. Therefore, by increasing the reserve fund, the board were strengthening the position of the company. Referring to the question of the adoption of the measured rate, the chairman said that the system, when it was introduced, caused quite a little excitement and opposition from chambers of commerce and other users, on the ground that the company's scale of charges would prove a heavy burden on those using that system. How unfounded and groundless those fears were, was proved by the fact that at the present time the company had in the provinces about 124,000 stations based on the measured rate system, producing in annual subscriptions or revenues an average annual income of £5 12s. 8d. for the use of a telephone station for a year. It must be a boon to have a telephone at that moderate figure, and that method of charge had become a boon to the small user, because no unlimited or other method could give to the user the use of the telephone at such a rate, and the small user was an advantage to the telephone system, because obviously the larger the system was the greater its use was to those already subscribing to it. That huge business with 16 millions of capital had been built up in spite of the most vigorous efforts which had been made from time to time to smother it and in face of the greatest possible difficulties, and it was satisfactory to know that we were to-day, as compared with any other country in Europe, with the exception of Germany, at the head of affairs in regard to the number of instruments per 100 of population, and considering their difficulties, he thought that was a fairly satisfactory position. He mentioned at the last meeting that in absence of agreement with the Postmaster-General as to the value of the company's assets, such value would have to be determined by arbitration, and that the company's officers were engaged in the preparations necessary for the inventory upon which the company's claim might be founded. Since that time work had still continued and the preparations were still proceeding. He noticed that the Postmaster-General, speaking the other night in the House of Commons on the Post Office Estimates, stated that he had very small hope that the purchase of the company could be settled otherwise than by arbitration. If that was so, as it probably was, the board had every confidence in the case which they would be able to put before the arbitrator, and whilst in the public interest they would always be ready to co-operate with the Postmaster-General as far as possible, the shareholders might rest assured that the board would strongly guard the interests committed to their care. The task before them was a very heavy one and as the Postmaster-General observed in his speech on the Estimates, the company constituted the most gigantic industrial operation that this country would ever know. The responsibility therefore upon the two parties to the operation was a very grave one involving as it did, not merely the immediate future of the telephone service of the country, but also to a large extent the happiness and comfort of the company's staff who had for so many years stood loyally by and served the company. Before they met again the inventory proceedings would have commenced. The staff of about 300, divided into groups, would be occupied for a period of probably more than 15 months on the inventory work in connection with the plant and the determination of its age, &c.

Mr. S. H. Sands seconded the motion, and the report was adopted.

Elektrizitäts Gesellschaft vorm. W. Lahmeyer & Co.

The report for 1909 of this Frankfort company states that a further satisfactory development took place in, and increased surpluses were realised by, the undertakings in possession of the company, those managed by it, and those in which the company is interested by way of shares. The Felten & Guilleaume-Lahmeyer Works, however, were compelled, owing to the specially unfavourable situation, to reduce their dividend from 8 to 6 per cent.; this implying a reduction of £16,000 to the Elektrizitäts Gesellschaft, which has also been compelled to lower its rate from 6 to 5 per cent., although the share capital participating is £1,250,000, as compared with £1,062,500 a year ago. The hope is expressed that the Felten & Guilleaume Co., in which the company holds shares amounting to £800,000, will in future be again able to show increasing results, especially having regard to the resumption of satisfactory employment in the dynamo works. The accounts exhibit the following figures for the past two years:—

	1909.	1908.
Share capital	£1,250,000	£1,062,500
Loan ,, ...	1,104,400	1,117,200
Net profits	72,700	75,300
Dividend, per cent.	5	6

The report gives particulars of the electricity works and tramways owned or operated by the company, and mentions that there is now a banking credit of £30,000.

Hendon Electric Supply Co., Ltd.

The directors' report for the year ended December 31st, 1909, states that the result of the year's working shows a credit balance of £1,095 on the revenue account. The net revenue account, after providing for sundry interest charges of £98, interest on debenture stock £1,500, and the debit balance brought forward from the previous year amounting to £1,479, shows a total debit of £1,970. Apart from the debit balance brought forward from the previous year, the revenue during 1909 was £503 less than the interest charges for the year. The year under review was the company's second working year. On December 31st, 1908, the company had connected 343 houses with 12,058 33-watt lamps, whereas on December 31st, 1909, these figures had increased to 830 houses with 23,055 33-watt lamps, and the company had received applications for 287 houses with 5,123 lamps. During the year under consideration £12,561 has been paid up on the subscribed share capital of the company, but no additional share capital has been issued. In accordance with the articles of association Mr. Carleton F. Tufnell retires from the board of directors, but offers himself for re-election.

At the third annual general meeting of the above company held on Thursday week, at Salisbury House, London Wall, with Mr. C. F. Tufnell in the chair, the report and accounts were adopted

Russian Electrical Companies.

The report for 1909 of the Russian Allgemeine Electricity Co., of St. Petersburg, one-half of whose capital is held by the Berlin A.E.G., states that the Government, as in the previous year, made no provision for funds for the allocation of orders which could cause a considerable revival in trade. On the other hand, the favourable harvest made itself felt in the second half of the year, and money in particular was so easy that payments were made more satisfactorily than at any previous time. The cities were certainly disposed to grant concessions, but the legal conditions, as well as the administrative difficulties, restrain capitalists from entering into such transactions. During the whole of the year, work proceeded normally at the Riga works, and the labour conditions were also satisfactory. The gross profits in 1909 amounted to £159,500, as compared with £150,300 in the preceding year, and the net profits were £76,900, and £67,500 in the two years respectively. It is proposed to pay a dividend at the rate of 6 per cent. on the increased share capital of £700,000, as contrasted with 6 per cent. on £600,000 in 1908.

The Russian Siemens & Halske Co., of St. Petersburg, in which the Berlin company of the same name is largely interested, realised a surplus of £38,900 in 1909, as compared with £32,000 in 1908. After providing for reserve and depreciation funds, the balance allows of the payment of a dividend at the rate of 5 per cent. on a share capital of £560,000, as contrasted with 4 per cent. in the previous 12 months. The orders received during the early months of the new financial year, show an increase over the corresponding period in 1909, but the directors state that it would be premature to draw from this circumstance a conclusion as to the complete year's results. The total demand in the empire is growing, although moderately, but the number of firms who seek to meet the requirements and the size of the equipment concerned is advancing to a still greater extent, so that prices are constantly falling.

The United Cable Works, of St. Petersburg, in which the two companies already mentioned are interested as large shareholders, earned net profits of £64,300 in 1909, as against £55,800 in the preceding year. It has been decided to distribute 7 per cent. on the share capital of £480,000, being the same rate as in 1908.

American Westinghouse Electric and Manufacturing Co.

The annual report of this company for the year ended March 31st, 1910, which was to be submitted at the annual meeting on July 27th, 1910, is printed in the New York *Electrical World*. The report includes the operations of the Westinghouse Lamp Co., the Perkins Electric Switch Manufacturing Co., the Bryant Electric Co. and the R. D. Nuttall Co. Mr. Robert Mather, chairman of the board, states that during the year the payment of dividends was resumed at the rate of 7 per cent. per annum on the preferred capital stock, and there was also paid 3½ per cent. on account of the deferred dividends on the preferred stock which had been unpaid since September 30th, 1907.

The surplus has been reduced by writing off for depreciation of investments in various European Westinghouse companies the sum of $5,723,251. The chairman states that as the result of his first examination into the affairs of the European companies during March and April, 1909, he recommended that the depreciation in the value of these investments be written into the accounts for the fiscal year ended March 31st, 1909, but action on the recommendation was then deferred; a further study of the conditions of the European companies, however, has resulted in writing down these items to the extent noted.

The gross earnings for the year ended March 31st, 1910, were $29,248,682; the net manufacturing profits were $3,552,978; other income aggregated $1,616,561, making a total income of $5,169,539, or an increase of $3,203,280 over the preceding year. After making deductions the net income for the year was $3,060,664, an increase of $3,979,346 over the preceding year. The value of unfilled orders on March 31st, 1910, was, in round numbers, $11,256,000, which is the largest in the history of the company with the exception of the year ended March 31st, 1907. During April and May of the present year additional orders were taken aggregating in value $7,083,000, and unfilled orders on May 31st aggregated over $13,000,000.

Since the close of the fiscal year $2,000,000 of treasury funds have been appropriated toward the payment of that amount of the $6,000,000 notes maturing August 1st, 1910, and arrangements have been completed for the extension of the remaining $4,000,000 of these notes for a further period of three years. By the above payment the funded debt of the company has been reduced since the receivership by $3,626,000, and the fixed annual interest charges thereby reduced by more than $200,000.

Chairman Mather states that the satisfactory results reflected in the report are largely due to the policy adopted by the board of liberal expenditures for increasing the effectiveness of the selling organisation and for development and improvement in design and in manufacturing methods. While this plan has added considerably to the expenses for the year, the increase is stated to have been amply justified both in the increased volume of business and in the decreased cost of production. A number of important lines of the company's product have been so improved by recent development and redesign as not only to decrease the cost of manufacture, but largely to increase the manufacturing capacity of the works, thus enabling the company to maintain and improve its position in the growing market for electrical machinery. Considerable expenditures have been made in adding to the equipment of the East Pittsburg works, and special mention is made of additions to the testing facilities, which have shown beneficial results in the inspection and testing of completed apparatus.

The increase of business during the fiscal year of the several subsidiary companies above mentioned, has also demanded an increase in their facilities. This has been provided for in the case of the Westinghouse Lamp Co. by equipping its New York factory at West Twenty-third Street, which has been closed since July, 1908, with complete modern machinery and facilities for the manufacture of 10,000 tungsten lamps per day. These additional facilities it is expected will be ready for use during August of this year. A new building now nearing completion will add approximately 22 per cent. to the floor space of the Bryant Electric Co. and the Perkins Electric Switch Manufacturing Co., and consideration is being given to plans for increasing the manufacturing facilities of the R. D. Nuttall Co.

The consolidated balance-sheet shows total assets of $83,588,000. Of this sum $14,974,000 is represented by property and factory plant; $13,893,000 in working and trading assets, including raw material and supplies, finished parts and machines, work in progress, goods on consignment and apparatus with customers; $27,206,000 by investments in stocks, bonds, debentures and collateral trust notes, including those of affiliated European and Canadian Westinghouse companies; $20,479,000 by current assets, including $7,040,000 in cash, $3,766,000 in notes receivable and $9,169,000 in accounts receivable. Charters, franchises, patents, insurance, taxes paid in advance, &c., enter in the assets for the sum of $6,083,000.

The main charges under liabilities are capital stock, $40,719,000; funded debt, $22,326,000; collateral notes, $8,720,000; readjustment notes, $1,387,000; current liabilities, $3,302,000; reserve, $1,280,000; surplus, $5,668,000.

As previously stated, the gross earnings for the year ended March 31st, 1910, were $29,248,682, leaving a net manufacturing profit of $3,552,978. Other income included interest and discount, $388,539; dividends and interest on stocks and bonds owned, $478,810; miscellaneous, including royalties, &c., $749,211, the aggregate being $1,616,561, thus bringing the total income up to $5,169,539. Deductions amounting to $2,108,875 were made from this amount, the principal items being interest on bonds and debentures, $1,112,320; interest on collateral notes, $496,000; property and plant depreciations, $243,522.

Continental Electrical Enterprises Co.

The directors of the Continentale Gesellschaft fur Elektrische Unternehmungen, of Nuremberg, which owns electrical undertakings in addition to being an investment company, report that further progress was made during the year 1909-10. The company is, or was, associated with the Schuckert Co., and all its ordinary shares of consenting shareholders were converted into preference shares several years ago, leaving only £44,000 of ordinary shares, the holders of which declined to accept the scheme of transformation, and who have since then not received any dividend. The accounts show the following results for the past two years:—

	1909-10.	1908-9.
Preference shares	£1,556,000	£1,556,000
Ordinary shares	44,000	44,000
Debentures	420,000	433,000
Net profits	80,200	70,900
Dividend on preference shares	4½	4

The undertakings under the direct management of the company are the suspended electric railway between Barmen, Elberfeld and Vohwinkel, and which yielded a surplus of £31,500 in 1909, as against £27,600 in 1908; and the electricity works at Berchtesgaden-Gunzburg-Jassy and Muhlhausen. The report gives particulars of other undertakings in which the company is financially interested in Germany and other countries, and mentions that the Rhenish-Schuckert Co. has concluded a long term contract with the State coal mines at Besbach, for the supply of coal which is to be used in connection with a central station for supply to the whole district of the Rhenish Palatinate. As the company has a banking credit at its disposal, it will be possible to embark upon new transactions in the current year as occasion may arise.

Great Northern and City Railway Co.—According to the report, the total receipts for the six months ended June 30th last amounted to £39,662 and the cost of working to £19,878, being at the rate of 50·12 per cent. The net revenue amounts to £19,783, which is insufficient to meet the company's fixed charges for the half-year. The sum of £3,162, which has been provided from outside sources, has enabled the company duly to meet these charges. The number of passengers for the six months under review, including season-ticket holders, was 5,966,114, as against 6,041,755 for the corresponding period last year. The number of local season tickets issued during the half-year was 2,589, as against 3,345 for the half-year ended June 30th, 1909. The number of three-route season-ticket holders using the company's line during the past half-year was 2,728, as against 2,725 for the corresponding half-year.

Chelsea Electricity Supply Co., Ltd.—An interim dividend at the rate of 4 per cent. per annum has been declared for the past half-year, being the same as last year.

Crompton & Co., Ltd.

The twenty-second annual general meeting of the shareholders of the above company was held on Thursday last week, at Salisbury House, London Wall, Mr. John Trotter in the chair.

The Chairman, in moving the adoption of the report (see page 114), said it was extremely disappointing to the directors to have to lay before the shareholders a balance-sheet which was so adverse as compared to those they had presented in previous years. In common with other manufacturers of electrical machinery, they had during the year under review suffered from excessive competition, and also from the falling off of orders, due, no doubt, to the want of confidence throughout business circles. The low prices had not only continued, but it had been difficult to get orders, which had necessitated their accepting a considerable amount of business at works costs, in order to keep the factory going. It was of vital importance in a business like theirs that the standing charges should be spread over as large an output as possible; and if they had contented themselves with taking orders at satisfactory prices the works standing charges would not have been covered, and the results would have been much worse than they appeared in the balance-sheet. He was against Protection as understood in political circles, but he did think that under existing fiscal conditions it was very difficult for the English electrical manufacturer to reap any reward against the foreigner. The electrical manufacturers of other countries, having their own markets reserved for them, could bring over here their surplus stocks, and thus compete at low prices with English concerns. He thought that if this question had only been kept outside party politics, it would have been settled long ago. Another factor which had tended towards the unfavourable results shown in the balance-sheet had been the low prices which had been obtained. The company had further suffered a heavy loss by litigation in connection with an order for a pumping plant. Still, another factor which was reflected in the accounts was that the accounts of the foreign branches were only relating to nine months. Those accounts were closed on December 31st as against theirs on March 31st. Of course, next year they would fall into line again. Turning to the accounts, freehold land and premises was about the same, £70,716. Plant, tools, furniture, &c., showed a reduction of £4,071, they now appearing at £73,799; stock-in-trade and work in progress was reduced by £31,000, and trade debtors were £18,000 less. On the other side of the accounts, sundry creditors and loans from bankers were down by £40,200. It was not satisfactory for a company to go on trading with permanent loans from its bankers, and they were accordingly taking steps to curtail their outstanding accounts on the one hand, and to reduce their liabilities on the other. The last item to which he referred had been considerably reduced since the close of the accounts. Their holding in the Electric Supply Corporation had been considerably reduced, and they now only held £24,000 worth of shares. They would remember that the shares represented the price paid to the company for the Chelmsford Electric Lighting Order, an undertaking which was started by them. The company had for some time a very large holding in the undertaking, but they thought it was a much larger one than they, as a manufacturing company, were entitled to, and so accordingly they had sold out some of their shares. The guarantee of the auxiliary company in connection with the earnings of the Supply Corporation had now expired, and the directors had thought it wise to write down the company's holding in the undertaking to £4 per share, taking the necessary amount for that purpose from the reserve fund. The directors felt that in course of time they would have no difficulty in disposing of the remaining shares which they held at satisfactory prices. During the financial year they had settled the claim on the policy of insurance held by the auxiliary company on terms which were considered favourable. Under the settlement the company's holding in the Electric Supply Corporation had been reduced by 3,000 shares of £5 each, £3,000 had been written off the investment in the auxiliary company, and the right of the insurance company to the first £10,000, repayable by the Electric Supply Corporation under the guarantee, reverted to the auxiliary company. The only other item which called for comment was the debit balance of £23,368, which was a most deplorable result. The directors had kept down the expenses as a precautionary measure, and they had saved some £5,000 on that head. It was only right, however, to point out that in the event of a revival in trade, the expenses would show a tendency to increase. With regard to the future, it only required a slight increase in market prices to have a marked effect upon the profit-earning capacity of the business. A great deal had been done by their technical staff to improve the designs of dynamos and motors, and as they all tended to economy in manufacture, they left a distinct margin for profit. The directors had decided after very careful consideration, to remove the headquarters of the sales department to Chelmsford, so that the heads of the various departments could keep in touch with the sales managers. During the second half of the year, the demand for their auto-converter had increased to such an extent that they had been able to write off the expenses of the experimental work, and the orders still came in at a satisfactory rate. He ventured to think that their works were in such a state of efficiency that they were able to manufacture goods at as low a price at Chelmsford as anywhere in this country, and in that respect they were in a good position to take advantage of the long hoped for revival in trade. Since the close of the financial year, there was a distinct improvement in the value of orders from their foreign branches, particularly was that the case in regard to the Australian and Bombay offices.

Col. Crompton, in seconding, said that, as most of them were aware, he was one of those that was hard hit by the state of the company's affairs. He was one of the original shareholders, and had a very large holding of shares, none of which he had sold. The fact of the matter was that the electrical industry, along with other trades, was under a depression. He did not think that their particular company was suffering any more than other concerns. Their unfavourable balance-sheet was brought about by two unforeseen circumstances—who could foresee the slipping of the foundations of a building when the most experienced architects of the day were unable to see any defects; and who could foresee such an extraordinary miscarriage of justice in the case which they had just fought? The interpretation of a few words in a specification had cost that company something like £7,000. No investigation of the company's affairs could have been more thorough than the one which he had made in order to see how his prospects stood, and he could assure them that nothing but prudence, patience, cutting down of expenses, and unremitting attention to everything that could secure or increase the sales, would ever bring them to a dividend-paying state.

The report was adopted.

German Cable Manufacturing Companies.

The report of the Norddeutsche Seekabelwerke Gesellschaft, of Nordenham, whose share capital of £300,000 is held in equal halves by the German Atlantic Telegraph Co. and the Felten and Guilleaume-Lahmeyer Works, shows net profits, after appropriating £20,900 in 1908, amounting to £68,100 for 1909, as compared with £5,980 in the preceding year. A dividend has been declared at the rate of 10 per cent., this contrasting with 4 per cent. which was paid out of the dividend and amortisation fund in 1908.

The directors of the Deutsche Kabelwerke Gesellschaft, of Berlin, state that the undertaking was well employed during 1909, although sale prices left something to be desired. Notwithstanding this fact, satisfactory results were obtained in consequence of the increase in the turnover, and the circumstance that raw materials were purchased on favourable terms. The subsidiary companies also had a large amount of business, including the Union Cable Co., of London, which likewise suffered from depression in prices. A net surplus of £23,700 was earned in 1909, as compared with £20,100 in the preceding year, and after providing £5,500 for depreciation, as against £5,200, the balance has allowed of the payment of 7 per cent. on the share capital of £175,000, as contrasted with 6 per cent. in 1908. An increase of 25 per cent. in the orders, as compared with the corresponding period in 1909, was reported at the recent annual meeting.

The Land und Seekabelwerke Gesellschaft, of Cologne-Nippes, experienced a greater degree of activity in 1909, but the value declined. The prices of the principal raw materials, such as copper and lead, were not subject to large fluctuations, but the price of rubber constantly increased during the year. After allocating £6,700 to depreciation, as against £7,300 in 1908, the accounts indicate net profits of £28,100, as contrasted with £29,200 in the previous year. A dividend of 8 per cent. was declared at the recent meeting on the share capital of £162,500, being the same rate as in 1908.

Liverpool Overhead Railway Co.

The half-yearly report to June 30th, 1910, states that the gross revenue amounted to £36,157, and the working expenses to £26,848. The number of passengers carried during the last two years was as follows:—

Half-year ending Dec. 31st, 1908.	Half-year ending June 30th, 1909.	Half-year ending Dec. 31st, 1909.	Half-year ending June 30th, 1910.
5,167,464	4,900,216	5,215,551	5,090,080

The slight improvement which has taken place in the trade of the port is reflected in the improved traffic. During the half-year the company carried 189,864 more passengers than in the corresponding half of last year, and the revenue increased by £824. A passenger lift has been erected at the Seaforth Sands station which has proved a great convenience to passengers. The Dock Board has approved of plans for the construction of a large dock for the use of Atlantic steamers, at the north end of their estate, which should bring increased traffic to the railway. From the balance of revenue account, £9,308, interest on mortgage debentures, and on calls paid in advance, absorb £4,329; leaving £4,979, which added to the balance brought forward, December 31st, 1909, £4,614, leaves available for dividend £9,593. Out of this balance the directors recommend dividends of 5 per cent. per annum (less income-tax) on the preference shares, leaving a balance of £5,917 to be carried forward to next half-year.

Metropolitan District Railway.—A dividend on the 4 per cent. guaranteed stock for the past six months at the rate of 4 per cent. per annum is recommended, as against 3 per cent. last year. Also a dividend on the first preference stock at the rate of 3 per cent. as compared with no dividend last year. £10,000 is placed to renewals and £8,527 is carried forward.

Charing Cross, West End and City Electricity Supply Co., Ltd.—The directors have declared an interim dividend at the rate of 5 per cent. per annum on the ordinary shares of the West End undertaking, being the same as last year.

Metropolitan Railway Co.

On Wednesday last week, the Rt. Hon. Sir Charles Mclaren' Bart., M.P., presided over the ordinary half-yearly meeting of this company, held at the Great Eastern Hotel, Liverpool Street.

The Chairman, in moving the adoption of the report (see Electrical Review, page 187), said that the receipts from passenger traffic on their own line showed an increase of £6,517, and the receipts from merchandise traffic an increase of £1,917, and on mineral traffic £1,228; while rents had increased by £2,122. The parcels traffic during the past half-year had also continued to grow in a satisfactory way. On the expenditure side of the revenue account there were one or two items that called for notice. The first was the amount of the expenditure on carriage and wagon repairs, which showed an increase of £3,300. With their larger train services they had necessarily more trains in daily use, and the maintenance was therefore heavier. Moreover, there was the further fact that the new stock which they purchased when they commenced electrical working, was now beginning to come in for renovation. In view of the fact that the customary quinquennial revaluation by the assessment committees in the Metropolitan area had taken place during the past half-year, they had taken steps to have a complete re-valuation made on their own account of the whole undertaking, as for some time past they had felt that their assessments were not on a proper basis in view of the altered circumstances of the undertaking, and the various and very serious forms of competition they had to meet, some of their competitors practically making no contribution to the local rates. They had been anxious in the past to avoid anything in the nature of litigation with the assessment authorities, but now that they had had the experience of a period of working under electrical conditions, which had put them in a position to judge as to the letting value of the hereditament to what the law called a hypothetical tenant, they felt that they were in a strong position to take the matter up, and to put it before the assessment committees in such a way as to avoid, if possible, any large expenditure in law costs in appeals to quarter sessions.

Turning to the credit side of the net revenue account, it would be seen that they brought in £2,767 less from the previous half-year than they did 12 months ago, but their receipts from the City lines were more by £550, and their proportion of the net revenue from the Metropolitan and Great Central joint line north of Harrow was more by £3,500. This latter was a very satisfactory feature in the accounts, and was a direct result of the growing popularity of the districts served by the joint line in question and of the efforts they had made to develop that traffic by running trains through to the City without change at Baker Street. On the other side of the net revenue account the only figure that he need refer to was the one of £10,000 which they proposed to place to the electrical renewal and depreciation fund as against £5,000 put to that fund in the corresponding half-year. He had referred on previous occasions to the wisdom of strengthening that fund as much as possible, and the action of the board in that matter had always been fully endorsed by the shareholders, and they thought it advisable to add the sum of £5,000 they had received from the Great Western Co. to the £5,000 which they usually set apart for electrical plant depreciation and to put the whole £10,000 to the fund on this occasion. In this connection he might say that they had lately had some very important negotiations with the British Westinghouse Co. in regard to the plant in their generating station at Neasden, with the result that they had entered into a contract with that firm for the renewal of a large portion of the machinery in a way that would not only largely increase the capacity of the power station, but would, they fully expected, result in a considerable economy in coal consumption. It was their intention to charge a considerable part of this expense to the electrical renewal and depreciation fund, which they had been building up for the purpose for some years past. The final result was that, after making the provision just referred to, they were able to pay an increased dividend of 1½ per cent., as against 1 per cent. in the corresponding half-year, and to carry £6,044 forward, as against £3,904 in the corresponding six months. The most encouraging feature about the revenue was that it showed an increase under all heads, and there was no doubt that, by carefully studying the requirements of the travelling public, and adapting their train services promptly to those requirements, they had induced a very considerable increase in travel by their trains. Having referred to the new works which the company had in hand, which included the provision of a new station at King's Cross, the building of an arcade over their Liverpool Street station, the provision of an additional subway at Praed Street, and the provision of an entrance to the Edgware Road Station from Marylebone Road, the chairman said that at the last meeting he referred to the scheme of conciliation boards, and stated that they had been able by means of these boards to settle the outstanding questions with all their men with the exception of those employed in the locomotive and electrical departments. Since that meeting further negotiations had taken place, and he was glad to be able to tell them that, as a result, satisfactory settlements had been arrived at with those sections of the staff, and that, consequently, the terms of service for the whole of their wage-earning men were now settled up to the end of 1913.

Sir William Birt seconded the motion.

Mr. Walford drew attention to the County Council's proposals to promote legislation next year for the construction of tramways to Cricklewood and Swiss Cottage, and remarked that if such schemes were sanctioned, it would mean serious competition with the Metropolitan Railway. He advised every stockholder to communicate with his member of Parliament, and get him to vote against the Bill on the first reading. He also put forward the suggestion that the company should see if it was possible to bring the Gower Street station down to Euston Square, and there have a connection with the London and North-Western Railway, and the Euston to Watford Railway. He thought if the company communicated with the London and North-Western Co., they might see their way to paying something towards this scheme.

Mr. Binney inquired as to what was being done with the surplus land at Edgware Road.

Col. Perry spoke at some length on the question of holidays granted to employés who were Territorials, and commented on the fact that if the men wanted to serve their full camping period they had to lose their pay.

The Chairman, replying to the observations of the shareholders, said with regard to Mr. Walford's remarks, he was afraid it was a physical impossibility to shift the position of Gower Street Station. It would cost such a large sum that if the directors brought forward the scheme the stockholders would want to turn them off the board. With regard to the County Council's tramway proposals, it certainly was an iniquitous thing that the company should have to fight a body which paid nothing for the privilege of running over the roads, and which was rate aided—they themselves contributing to such rates. They were prepared to fight the scheme if it should ever get to the Committee stage. Fortunately, the local authorities had the right of vetoing the proposals, and it would be remembered they did so last year. As to the vacant land at Edgware Road, they were only waiting for an adequate offer for it. With reference to the remarks of Col. Perry, he pointed out that the company allowed their men four days' holiday with full pay, and they could have the other days in order to complete their full period of camping at their own expense.

The report was adopted.

Berlin Accumulator Works Co.

The shareholders in the Akkumulatorenfabrik Gesellschaft, of Berlin and Hagen, which controls the Tudor patents in Germany, and has the largest share of the secondary battery trade in that country, approved at the recent meeting the payment of a dividend of 12½ per cent., being the same rate as in each of the five preceding years. According to the directors' report for 1909, a certain change has taken place in the battery trade, inasmuch as the turnover has been somewhat restricted in regard to batteries for stationary purposes in those districts where the general supply of electricity is being effected from "overland" central stations; but, on the other hand, there has been a still greater employment of the so-called transportable type of accumulator, particularly for traction uses of all kinds. The development of this newly-opened market is, however, only proceeding slowly, so that the decline in the orders for stationary work could only be partly recouped during the year. The book turnover of the company's works in Germany and Austria amounted to £870,900, as compared with £961,500 in 1908, but by means of improvements in manufacturing processes, economies in working expenses and larger profits from investments, it was possible to distribute the same dividend as in the previous year. The accounts show the following figures for the past two years:—

	1909.	1908.
Share capital	£400,000	£400,000
Bond capital	150,000	150,000
Gross receipts	285,200	318,800
Depreciation provision ...	5,360	19,500
Net profits	79,450	75,300
Dividend	50,000	50,000
„ per cent.... ...	12½	12½

The report does not give any information respecting the companies in which this company is interested, it being merely stated that they had also made prepayments on the dividends during the year. The ordinary reserve fund remains unchanged at £80,000, and the premium reserve fund, which is for the purpose of ensuring the maintenance of consumers' batteries, has been increased to £189,000, whilst the bank credit amounts to £191,000, as contrasted with £76,800 at the end of 1908. It was mentioned at the recent meeting that the orders on hand are somewhat larger than a year ago, the situation being without change in other respects.

Elmore's German and Austro-Hungarian Metal Co., Ltd.—We are informed that during the six months ending June 30th last, the sale of tubes, &c., produced at Schladern shows an increase of 5·15 per cent. in tonnage over the amount sold during the six months ending June 30th, 1909. The weight of orders and contracts in hand amounts to 500 tons. The Metall Co. has entered into a contract for the supply of copper rollers necessary for the satisfactory and economical working of an invention, which it is believed will ultimately prove of great value to the printing and allied trades. The scheme for the rearrangement of capital, to which the chairman referred in his speech on May 11th last has not been proceeded with, owing to opposition by the holders of a considerable amount of debenture stock, but with an improvement in the selling price of copper tubes, coupled with a satisfactory return from the above-mentioned contract, it may not be necessary to proceed further with such scheme, and the directors have decided to allow the matter to remain in abeyance until the end of the year.

MARKET QUOTATIONS.

Wednesday, August 3rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a " Nitric	"	22/-	..
a " Oxalic	"	28/-	..
a " Sulphuric	"	5/6	..
a Ammoniac, Sal	"	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a " "	"	£30	..
a Bleaching powder	"	£5 10	..
a Bisulphide of Carbon	"	£18	..
a Borax	"	£16	..
a Ferro-Silicon (50 %)	"	£9 10	..
a Copper Sulphate	"	£18	..
a Lead, Nitrate	"	£25	..
a " White Sugar	"	£23 10	..
a " Peroxide	"	£33	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£30	..
a " Chlorate	per lb.	8½d.	..
a " Perchlorate	"	4½d.	..
a Potassium, Cyanide	"	7d.	..
a Shellac	per cwt.	88/-	3/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	"	£6 10	..
a " Recovered	"	£5 10	..
a " Lump	"	£5	..
a Soda, Caustic (white 70 %)	"	£11	..
a " Chlorate	per lb.	3½d.	..
a " Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	8d.	..
a " Cyanide (basis 100 %)	"	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b " Wire, in ton lots	"	£112	..
b " Sheet, in ton lots	"	£120	..
p Babbitt's metal ingots	"	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	6¼d.	⅛d. dec.
c " Tube (brazed)	"	8⅜d.	⅛d. dec.
c " " (solid drawn)	"	6¼d.	⅛d. dec.
c " Wire, basis	"	6⅜d.	⅛d. inc.
c Copper Tubes (brazed)	"	8⅜d.	⅛d. inc.
c " " (solid drawn	"	8⅜d.	⅛d. inc.
g " Bars (best selected)	per ton	£70	£2 inc.
g " Sheet	"	£70	£2 inc.
g " Rod	"	£70	£2 inc.
e " (Electrolytic) Bars	"	£58 10	15/- inc.
e " " Sheets	"	£74 15	15/- inc.
e " " Rod	"	£73 5	15/- inc.
e " " H.C. Wire	per lb.	7¾d.	⅛d. inc.
f Ebonite Rod	"	6/-	..
f " Sheet	"	5/6	..
n German Silver Wire	"	1/6	..
h Gutta-percha, fine	"	..	..
h India-rubber, Para fine	"	8/10	1/4 dec.
i Iron Pig (Cleveland warrants)	per ton	49/3	3d. inc.
l " Wire, galv. No. 8, P.O. qual.	"	£14	..
g Lead, English Ingot	"	£12 15 to £12 17 6	dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 12 6	2/6 dec.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d " " medium	"	2/6 to 4/-	..
d " " large	"	4/6 to 8/6	..
p Phosphor Bronze, plain castings	"	11d.	..
p " " rolled bars & rods	"	1/1½	1½d. dec.
p " " rolled strip & sheet	"	1/3	1d. dec.
o Platinum	per oz.	130/-	..
e Silicium Bronze Wire	per lb.	87d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	"	£149 to £150	£2 inc.
n " Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals:— "Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	"	£26 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

North-Eastern Railway.—The report for the half-year ended June 30th states that the directors recommend a dividend at the rate of 5 per cent. per annum. In reference to the Tyneside electrically worked lines, the electric passenger train-mileage amounted to 596,654, and the electric goods mileage to 2,537. The electric passenger car-mileage was 1,836,048, and the cost of electrical energy purchased is given as £12,212, and of wages of trainmen as £3,765. These figures show a very slight increase over those of the corresponding period of last year.

Westminster Electric Supply Corporation, Ltd.—The directors have declared an interim dividend for the half-year ended June 30th, 1910, at the rate of 10 per cent. per annum, less income-tax, payable on September 1st next.

Hadfield's Steel Foundry Co., Ltd.—The directors have declared an interim dividend of 1s. per share on the ordinary shares.

Harper Electric Piano Co.—Dividend on the deferred shares at the rate of 15 per cent. per annum, carrying forward £1,888.

STOCKS AND SHARES.

Tuesday Evening.

Thanks to a rather better atmosphere on the other side of the Atlantic, markets have turned firmer. Of course the holiday feeling is very much in evidence, and militates a good deal against any material increase in business. At the same time, it is satisfactory to be able to report the harder tone which obtains all round the markets.

The Home Railway market has once more taken its place as the leader of the domestic sections. Some of the dividends declared within the last few days have been unexpectedly satisfactory, and this, combined with the greater favour with which the maket has come to be regarded by the investor, has helped to put prices on a higher basis.

The Metropolitan District Company surprised even its warmest supporters by declaring for the first time in 10 years a dividend on its 5 per cent. Preference Stock, and although only at the rate of 3 per cent., it is considered an earnest of the company's being able to meet the full interest before very long. Indeed at 70, the current quotation, the stock looks reasonably cheap, in view of the fact that a repetition of the same rate would mean 4 per cent. on the money, to say nothing of the prospect of the full 5 per cent being distributed within the course of the next few half-years. The price rose to 21½, but dropped a little, as did also Metropolitan Consolidated just before the Bank Holiday, when the brilliant weather encouraged the idea that the Undergrounds would be more or less deserted over the recess. The Central London report provides a good deal of encouragement for the proprietors, but has failed to exercise any influence on the price of the Stocks.

After the Home Railway market, there is not much of interest except as regards Anglo-American Telegraph Deferred Stock, which has enjoyed another sharp rise by reason of the chairman's speech at the end of last week. While the speech was by no means unmixed with sobering reflections, the fact of the negotiations being still in course with the American Telephone and Telegraph Company is considered satisfactory enough to over-ride other considerations. The nigger in the hedge is the way in which the company's investments have declined, the depreciation amounting now to nearly £100,000. Direct United States shares have improved in sympathy.

The earnings of the American Telephone Company for the month of June have been cabled this week as $13,803,000 gross, and $3,937,000 net, the latter being an increase of $212,000. Nevertheless, the price is a point or so lower. Monte Video Telephones are slightly easier, but Chili Telephones, *ex* 5s. dividend, have not altered.

Marconi shares remain about 15s., notwithstanding the fine advertisement which wireless telegraphy has secured in consequence of the public interest taken in the Crippen case.

The National Telephone group is unaltered. To some investors the company's Preferred stock offers attraction in that it is a 6 per cent. investment standing at a few points above par—the price carries 3 per cent. dividend payable this month—and that it is fairly certain to get at least par in the distribution of assets when the company becomes absorbed by the Government.

Electricity Supply shares are in many cases quoted *ex* dividend, and it may be of service to set out the amounts deducted, which are as follows:—

Share.	Dividend. s. d.	Share.	Dividend. s. d.
City Ord.	6 0	Newcastle Pref.	2 6
Do. Pref.	6 0	St. James' Ord.	5 0
County Ord.	4 0	Do. Pref.	3 6
Do. Pref.	6 0	Westminster Ord.	5 0
Newcastle Ord.	1 6		

The fractions which the shares have fallen represent, roughly, the dividends. Metropolitan Ordinary are still *cum* dividend, but have fallen 5s. by reason of the reduction in the dividend from 5 per cent. to 4 per cent.—noticed here last week. It need hardly be said that business in all the electric lighting shares is very quiet. A revival at the end of the autumn is hoped for by some, but the prolonged stagnation has done much to kill even the most modest bullishness. At the same time, it is at least likely that the advertising campaign may make its influence felt upon the companies' profits in the current six months.

The Canadian-Mexican group is quiet, without material alteration, and the traction issues are all steady. In the manufacturing group, British Insulated are 5s. higher, but Telegraph Constructions have eased off. Henley's are a better market at rising prices. Rubber shares are in holiday condition, the unsettlement in the American market checking any incipient inclination there might otherwise be to better prices in the rubber section.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations July 26th.	Closing Quotations Aug. 2nd.	Business done week ended Aug. 2nd, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — 3¼	3⅜ — 3⅝	..	..	..	Nil.
286,500	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	95 — 97	95 — 97	..	..	..	4 17 7
$255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	8 %	136 —138	134 —137	135	..	—1½	5 16 10
$ 53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	91 — 93	91 — 93	..	..	..	4 6 0
558,460	Anglo-American Telegraph	Stock	3½%	3½%	£3 4s.	3½%	63½— 65½	64½— 66½ xd	63½	..	..	5 9 0
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	106 —108	107 —109 xd	108½	107 7/16	..	5 10 1
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	24½— 25	26½—26¾	26½	24	+1¾	4 13 6
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	9 — 9⅛	9 — 9⅛ xd	9¼	..	..	4 4 3
2,449,176	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	83½— 85½	83½— 85½	85¼	..	..	4 13 7
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8⅛ — 9	8½ — 9	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½— 17½	16½— 17½	..	..	..	5 15 11
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7½ — 8¼	7½ — 8¼	..	..	..	6 1 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
60,710	Direct United States Cable	20	4½%	4½%	4½%	4 %	14½ — 15	14½ — 15½	14½	..	+ ¼	5 4 11
36,000	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	98	..	..	4 10 0
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	132 —135	132 —135	133½	132½	..	5 3 8
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	83 — 85	84 — 86	85⅛	84½	+1	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅜—12⅝	12⅜— 12⅝	12⅜	12⅜	..	5 8 9
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	99 —102 xd	99⅛	..	—2	3 18 5
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5½%	5½%	5⅝%	5⅞%	10½— 10⅝	10½— 10⅝	10 21/32	10 5/16	..	5 10 3
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13 — 13½	13 — 13½	13⅛	13⅛	..	4 8 11
150,000	Great Northern Telegraph, of Copenhagen..	10	20 %	20 %	18 %	..	29½— 30¾	29½— 30½	..	..	..	6 3 0
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	53 — 55	53 — 55	54½	..	..	6 15 8
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	86 — 90	84 — 88	..	..	—2	4 16 7
$50,000,000	Do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	76 — 80	76 — 80	..	..	..	5 0 0
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	1 — 1 1/16	1 — 1 1/16	18/9	16/10½	— 1/16	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	31/32 — 1	31/32 — 1	..	..	..	6 3 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½—108	106½—108	107½	106⅜	..	5 11 1
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	126½—128½	126½—128½	128	127	..	4 13 5
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10⅝ — 10¾	10⅝ — 10¾	..	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10⅝ — 10¾	10⅝ — 10¾	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 7/16 — 5 11/16	5 5/16 — 5 1/16	..	..	..	4 7 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96 — 98	96 — 98	..	..	..	3 11 5
1,983,593	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	7 %	8 %	8 %	8 %	1 7/16 — 1 11/16	1 7/16 — 1 11/16	..	..	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	4 14 9
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8	7⅞ — 8	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	98 —100	98 —100	98¼	..	..	4 10 0
3,042	Submarine Cables Trust..	Cert.	6 %	6 %	6 %	..	128—131	128 —131	..	..	..	4 11 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞ — 7⅛	6⅞ — 7 xd	7 1/16	6 1/16	..	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 5/16 — 5 7/16	5 5/16 — 5 7/16	..	..	..	4 15 3
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅛ — 1⅜	1 1/16 — 1 1/8	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	7 %	13⅜— 14½	13⅜— 14½	14	13⅜	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	3 19 3
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	2/8 — 3/8	2/8 — 3/8	13/9	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	6 %	8¼ — 9	8½ — 9	8¾	..	..	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	14⅓%	8 — 9	8 — 9	..	..	..	16 12 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99 —101	99 —101	..	..	..	4 19 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	..	5 %	4 5/16 — 4 9/16	4 5/16 — 4 9/16	88/9	87/6	..	5 9 7
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	..	5 %	4 3/16 — 4 7/16	4 3/16 — 4 7/16	87/6	..	..	5 12 8
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90 — 91½	90 — 91½	91	90½	..	4 7 5
332,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
830,000	Babcock & Wilcox, 1 to 830,000	1	20 %	20 %	20 %	24 %	5 5/16 — 5 7/16	5 3/8 — 5 7/16	..	..	— 1/8	4 7 8
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	3 19 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	140 —145	140 —145	143	142½	..	5 10 4
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	124 —128	122 —126	..	..	—2	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	108 —111	108 —110	..	..	..	4 10 1
233,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4 %	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
133,301	British Electric Traction	10	Nil	Nil	Nil	Nil	½ — 1	½ — 1	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1½%	Nil	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	87 — 91	87 — 91	..	..	..	5 9 11
528,336	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	68 — 73	68 — 73	70	..	..	6 3 3
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6¾ — 7	6⅞ — 7⅛	6⅞	..	+ ¼	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅛	5⅞ — 6¼ xd	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
204,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	5/16 — 9/16	5/16 — 9/16	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	61 — 63	61 — 63	..	..	..	6 7 0
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref... ..	2	Nil	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	23 — 27	23 — 27	..	..	..	16 13 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4 — 4¼	4 — 4¼	85/-	..	..	5 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	5 %	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 1 3
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9¼ — 10¼	9¼ — 10¼	..	..	..	4 17 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4⅝ — 5¼	4⅝ — 5¼	..	..	..	4 15 3
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100½—102½	100¾—102½	..	..	..	4 7 10
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	¼ — ⅜	¼ — ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	2⅜ — 2½	2⅜ — 2½	54/4½	..	..	4 10 11
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	106 —109	104 —107 xd	..	..	..	4 4 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3⅓ %	3 %	66 — 68	66 — 68	66½	66	..	4 8 3
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 12
554,655	Do. do. Def. do.	Stock	4 %	2 %	2⅓ %	2 %	49 — 51	49 — 51	..	..	..	3 18 5
1,480,000	City and South London Railway	Stock	2⅓%	2⅓%	1⅓%	1⅓%	28 — 29	27⅞ — 28½ xd	27⅞	..	..	6 2 10
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	Nil	⅛ — ¼	⅛ — ¼	10/-	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	84— 87	84 — 87	..	..	..	5 14 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations July 25th.	Closing Quotations Aug. 2nd.	Business done week ended Aug. 2nd, 1910. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	6 %	1 1/16 — 1 3/16	1 1/8 — 1 3/16	..	..	..	5 1 1
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1 1/8	1 — 1 1/8	..	..	..	5 6 8
271,030	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	2½%	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
17,139	Do. "A" shares, 01—017,139	5	4½%	2½%	Nil	Nil	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	63 — 68	63 — 68	..	..	..	5 17 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/4 — 3/8	1/4 — 3/8	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1 3/8 — 1 5/8	1 1/4 — 1 1/2xd	..	..	..	9 6 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7 3/4 — 8	7 3/4 — 8	..	..	..	6 5 0
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	½%	Nil	Nil	3/8 — 1	3/8 — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10 1/4 — 10 3/4	10 1/4 — 10 3/4	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103 1/2	102 —103 1/2	..	..	..	4 16 10
40,000	Henley's (W.T.) Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	11 7/8 — 12 1/8	12 — 12 1/8	12 1/2	12 1/16	+ 1/4	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4 7/8 — 5 1/4	4 7/8 — 5 1/4	..	..	..	4 5 9
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	103 —105 1/2	101 —106	..	..	+ 1/2	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	14 1/2 — 15 1/4	14 1/2 — 15 1/4	..	..	..	6 11 2
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	½%	Nil	Nil	1/16 — 1/8	1/4 — 1	..	..	..	Nil†
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 5 1/2	5 — 5 1/2	..	..	..	9 1 10
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	3 %	Nil	..	1 1/2 — 2 1/4	1 1/2 — 2 1/2	..	..	..	Nil
399,930	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1 1/4 — 2 1/4	1 1/2 — 2 1/2	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3 3/4%	..	2 — 2 1/8	2 — 2 1/8	40/3	..	..	15 0 0
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 71	67 — 71	..	..	..	5 12 8
5,732,062	Metropolitan Consolidated	100	1 %	¾%	¾%	1 %	38 3/4 — 39 1/4	38 3/4 — 39xd	38 3/4	38 5/8	..	2 11 3
2,640,914	Do. Surplus Lands	100	2½%	2¾%	2½%	2½%	66 —68	65 — 67xd	66	..	..	4 2 1
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	20 1/4 — 20 3/4	20 1/4 — 21	21 1/8	20 11/16	+ 1/4	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	..	2 1/4 — 2 5/16	2 1/4 — 2 5/16	..	..	..	5 15 0
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/2 — 5/8	1/2 — 5/8	17/-	..	..	5 9 7
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	97	..	..	4 10 11
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	6 %	121 —123	119 —121	121 1/2	120	—1½	4 19 2
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	5 %	97 1/2 — 98 1/2	98 — 99	99	98 1/4	+ 1/2	5 1 0
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	3/8 — 1/2	3/8 — 1/2	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/4 — 7/8	3/4 — 7/8	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	33 1/2 — 35 1/2	33 1/2 — 35 1/2	35	34 1/2	— 1/2	5 18 8
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99 —101	99 1/2 —101 1/2	..	..	+ 1/2	3 18 11
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	..	5 %	..	102 —103	102 1/2 —103 1/2	103	102 1/2	+ 1/2	4 16 7
2,800,000	Do. do. 4½ % Bonds	..	..	..	4½%	4½%	86 — 88	86 — 88	..	..	..	5 2 3
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	34 — 36	36 — 38	36	..	+2	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	1/2 — 3/4	1/2 — 3/4	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1 1/2 — 1 3/4	1 1/2 — 1 3/4	..	..	..	8 11 5
215,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	60 — 70	60 — 70	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	7 1/4 — 7 3/8	7 1/4 — 7 3/8	..	..	..	6 9 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7 1/4	7 — 7 1/4	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
50,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3 3/4 — 4	3 3/4 — 4	72/6	..	..	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4 %	4 %	4 1/4 — 4 3/8	4 1/4 — 4 3/8	..	..	..	4 16 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4 %	4 %	3 7/8 — 4 1/8	3 7/8 — 4 1/8	..	..	..	4 17 0
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4 %	3 3/4 — 4 1/4	3 3/4 — 4 1/4	..	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4 %	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11 1/2 — 12	11 1/2 — 11 3/4 xd	11 7/16	..	..	6 0 5
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11 1/4 — 12 1/2	11 1/2 — 12 1/4 xd	11 5/32	..	..	4 19 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	119 —123	119 —123	..	..	..	4 1 4
£00,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 1/2 —102 1/2	99 1/2 —102 1/2	..	..	..	4 7 10
£0,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1 1/2 — 2	1 1/2 — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2 3/8 — 3 1/4	2 3/8 — 3 1/4	..	..	..	7 13 10
2?0,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94 1/2 — 96 1/2	94 1/2 — 96 1/2	..	..	..	5 3 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7 3/8 — 8	7 3/8 — 7 5/8 xd	..	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10 3/4 — 11 1/4	10 3/4 — 11 xd	11 1/16	..	..	5 9 1
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	103 1/2 —106 1/2	103 1/2 —106 1/2	105 1/2	105 1/4	..	4 4 6
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4 %	4½%	4½%	4½%	99 —102	99 —102	101 1/2	..	..	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1 1/4 — 1 3/4	1 1/4 — 1 3/4	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	75 — 78	75 — 78	76 1/2	75	..	5 15 5
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	85 — 88	85 — 88	86 1/4	..	..	5 8 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4 1/4 — 4 3/4	4 1/4 — 4 3/4	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5 1/2	5 — 5 1/2	..	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 — 7 1/2	7 — 7 1/2	..	..	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	7 — 7 1/2	7 — 7 1/2	..	..	..	5 6 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 1/2 — 96 1/2	93 — 95 xd	..	..	..	4 4 3
11,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2 %	3 %	..	1 7/8 — 2	1 7/8 — 2	36/3	..	..	4 8 11
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	5 — 5 1/4	5 — 5 1/4	5 5/32	5 1/8	..	5 14 3
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	..	..	..	4 7 7
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3 1/4 — 3 3/8	3 — 3 1/8	66/10 1/2	65/-	— 1/4	7 2 10
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4 — 4 1/2	4 — 4 1/2	85/-	..	..	5 0 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	82 — 85	82 — 85	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds.	100	5 %	5 %	5 %	5 %	85 — 86	85 — 86	85 1/2	..	..	5 16 3
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	4 %	3½%	4 %	77 — 79	77 — 79	77 3/4	..	..	5 1 3
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	101 1/4 —103 1/2	101 —103	102 3/8	101 1/4	— 1/2	6 15 11
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	93 3/8 — 94 3/8	91 1/2 — 92 1/2 xd	94 3/4	92	..	5 8 1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 1/2 — 97 1/2	95 1/2 — 97 1/2	..	..	..	4 12 4
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	3 7/8 — 4 1/8	3 3/4 — 4 1/4 xd	..	..	..	2 19 0
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4 3/8 — 4 5/8	4 1/4 — 4 1/2 xd	..	..	..	5 5 3
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	..	5 %	100 —102	100 —102	..	..	..	4 18 0
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12 — 13	12 — 13	12 1/8	12 1/16	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6 1/2 — 7	6 1/2 — 7	..	..	..	5 0 0
119,694	River Plate Electy. Co. Ord.	Stock	2½%	6 %	8 %	9 %	210—225	210 — 225	..	..	..	4 0 4
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	6 %	105—115	105— 115	..	..	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100 1/2 —102 1/2	100 1/2 —102 1/2	..	..	..	4 17 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8 1/2 — 8 3/4	7 1/2 — 8 1/2 xd	8 3/16	8	..	5 19 5
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6 3/4 — 7 1/8	6 3/4 — 7 1/4 xd	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	84 — 86	84 — 86	..	..	..	4 1 5
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1 1/2 — 2	1 1/2 — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2 1/2 — 3 1/2	2 1/2 — 3 1/2	..	..	..	6 9 0
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	1/4 — 3/8	1/4 — 3/8	..	..	..	5 0 0
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1 1/8	1/16 — 1 1/16	..	..	— 1/16	6 11 9
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4 %	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	3/4 — 1	3/4 — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2 1/4	2 — 2 1/4	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	3/4 — 7/8	3/4 — 7/8	..	..	..	5 14 3
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8 1/2 — 8 3/4	8 1/2 — 8 3/8 xd	..	..	..	5 15 11
£1,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	4 1/2 — 5 1/2	4 1/2 — 5 1/2	..	..	..	5 1 5

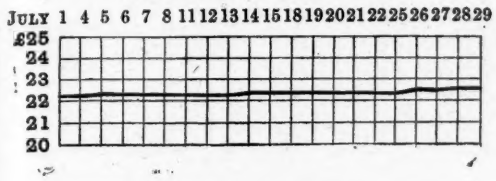
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent. June 9th. 1910.

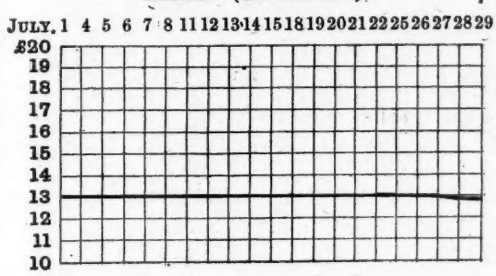
METAL MARKET.

Fluctuations in July.

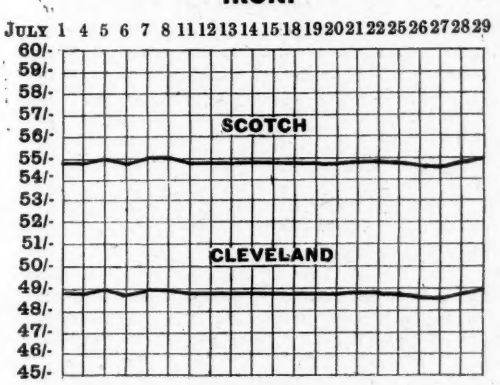
SPELTER (G.O.B's.).



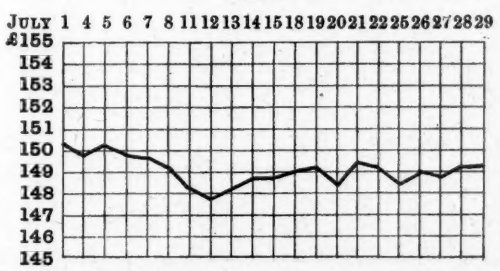
LEAD (ENGLISH).



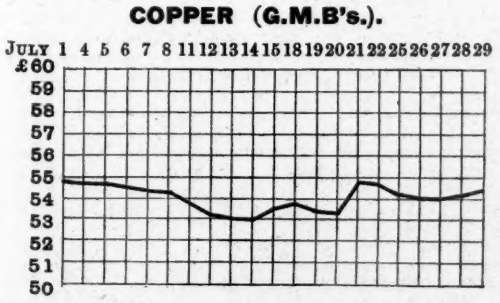
IRON.



TIN.



COPPER (G.M.B's.).



St. Annes-on-Sea Electric Lighting.—The U.D.C. has received from the L.G.B. sanction to a loan of £3,500 for extensions to the electricity works.

REVIEWS.

Dynamo-Electric Machinery: Alternating-Current Machines. By Messrs. Sheldon, Mason & Hausmann. London: Crosby Lockwood & Co. Price 12s. net. Eighth Edition.

Two of the authors are teachers in electrical engineering at important institutions in the United States, and the book has been prepared primarily for the use of their students. There is rather too much mathematics for the ordinary reader, and terms are used which have not yet got beyond the lecture room. For example, the article dealing with Impedances is followed by one headed Polygon of *Admittances*, which is apparently on the same lines as that given by Mr. Simmons in his book, "Outlines of Electrical Engineering." The chapter commences, "If a group of several impedances, z_1, z_2, &c., be connected in parallel to a common source of harmonic E.M.F. of E volts, their equivalent impedance is most easily determined by considering their *admittances*, Y_1, Y_2, &c."

A little further along the word *susceptance* appears, and on page 73 it is defined as that quantity by which E must be multiplied to give the component of I perpendicular to E.

Under alternating-current motors, coil end leakage is gone into at some length, and many pages are devoted to the various heroic devices for making single-phase motors behave properly.

The mercury vapour converter is illustrated and described in the chapter dealing with rotary converters.

The power transmission chapter is not bad, especially the series of calculations for an aluminium line to transmit 5,000 KW. 100 miles at 66,000 volts. Mention is made of Electrose as a substitute for porcelain and glass for high-tension insulators. It is said to be mechanically strong, and free from cracks, has a brown smooth-polished surface, and does not absorb moisture.

The writer cannot recommend the book to English readers.—E. K. S.

Lecture Notes on the Theory of Electrical Measurements. By W. A. Anthony and Albert Ball. New York: Wiley & Sons. Price 4s. 6d.

This is a small treatise of some 118 pages, containing 17 chapters, dealing with the C.G.S. system, magnetic field potential, resistance, heating effects of currents, incandescent and arc lighting, electromagnetism, &c.

Since the book is written for "the third year classes of the Cooper Union Night School of Science," it is obviously intended to give an outline of testing, &c., in the smallest possible space.

Naturally, the book suffers from the effect of its brevity, and the statements made therein will often puzzle the student. He will wonder, for instance (page 13) why "Lines of force can never cross each other, for if they did, that would mean two directions of the magnetic force at the point of crossing." He will think of the ordinary parallelogram of forces, and doubtless of rotating magnetic fields.

Also (page 37) "Electricity like water seeks its own level, and, left to itself, difference of potential would sooner or later disappear." Why should it disappear?

On page 38 "E.M.F. is measured by the difference of potential it can produce." This does not seem to the writer to be quite correct, since in hot wire ammeters, moving coil permanent magnet type instruments, and instruments having a solenoid and iron armature, the E.M.F. is measured by an application of Ohm's Law, the effect due to the current being assumed proportional to the E.M.F.

On the same page, lower down, "When a conductor is moved across a magnetic field an E.M.F. in general exists." It would be better to write "cuts" instead of "is moved across."

On page 59 a method is given of measuring the resistance of an electrolyte, which, although probably accurate enough for practical purposes, could not be recommended.

"Economy in incandescent lighting requires that the carbon filament shall be maintained at as high a temperature as it will bear without a too rapid deterioration, for the reason that the ratio of light emitted to energy consumed increases very rapidly as the temperature increases." This is apparently quite true, but surely the student will ask, "Why?"

Referring to measurements of permeability, p. 101: "This is best done by determining the 'E.M.F. induced in a small test coil, &c.'" This seems to be a slip, and "quantity of electricity" is really intended instead of E.M.F.

On page 106 the magnetometer method of testing iron is referred to as "not adapted to exact determination." It seems to the writer that it is eminently adapted to exact determinations, and if the magnetometer is a reflecting one there seems no reason why the accuracy should be any less than in a ballistic test. As a rule, in ballistic testing there are several uncertainties which do not exist in the older magnetometer method.

The end of the book is occupied with a simple theory of the ballistic galvanometer, and a formula for a D'Arsonval type ballistic galvanometer is worked out.

The book is neatly printed, and, doubtless, will be a useful work to those students for whom it is written, and as a brief *résumé* of electrical testing may be recommended to those who have little time to study the larger treatises.

Electricity. By H. M. Hobart, B.Sc., M.Inst.C.E. London: Constable & Co., Ltd. 1909. Price 6s. net.

This little volume with the comprehensive title consists of about 200 pages, and is, like all the productions of the same author, worthy of serious consideration. It has caused the reviewer very serious consideration.

In the first place it is "dedicated to the memory of the late Hugh Erat Harrison," a somewhat unusual though withal a pretty little touch to find in a scientific textbook.

Then this volume is evidently intended as an elementary treatise on electricity, for the author believes that "almost anyone who is in earnest can make good progress in acquiring a fundamental knowledge of the subject of electricity by a careful study of the present treatise." At the same time he hopes "it is not a book which will be read and laid aside" because it contains "investigations into aspects of difficult matters," in which "in several instances a main motive for the investigations has been to endeavour *to make clear to myself* (the italics are the author's) points which I have realised had heretofore been rather obscure to me." It will, therefore, be perfectly clear to anyone, without the additional information that "friction machines, electric eels, frog's legs, pith balls, lodestones, sealing-wax, cat's skins, the electrophorus, the aurora borealis, St. Elmo's fire and Benjamin Franklin's kite," have all been relegated to the old curiosity shop; and that this treatise on Electricity—elementary, if you will—follows very original lines.

Originality is a very desirable feature in a text-book if kept within proper limits, and just here lies the reviewer's difficulty in coming to a definite decision. The author starts the "earnest" student on the royal road to electricity and carries us on quite smoothly and logically until we discover that he has left us in a very pretty but somewhat dense forest of "insulating materials," when he awakens us to our position by asserting "that it would be useless to draw final conclusions from other than most exhaustive tests . . . . and there would appear to be no difficulty in obtaining most valuable results from students' work on these lines." Also "the amount of work requiring to be done is inexhaustible"; are we then to conclude that the author has taken us into this almost *terra incognita* just in order that we may all use our axes of scientific research and hew out for ourselves, and the author, a broader road to light and liberty?

There are some originalities which distinctly are not improvements. Throughout the book the author uses a comma instead of the usual decimal sign; the expression ampere-turns is abbreviated to ats without the slightest distinction from the surrounding type and similarly root mean square is denoted by rms. Such deviations from commonly accepted practice serve no apparent object.

There is an error in the diagram, fig. 93, page 143; magnetic area 4 sq. cm. should read 1 sq. cm. On page 148 $\sqrt{5^2 + 7^2} = \sqrt{74} = 8{\cdot}6$, but on page 150 *et seq.* 8·4 is taken as the result, and problems are worked out with that figure as a basis.

In the first chapter, the Generation and Conduction of Electricity, the author is careful to explain that electricity is not "generated" in a "generator," and he justifies the use of the expression by reference to the process of "making" cake "when, by suitable agency, we transform material substances such as eggs, flour and milk into material substance, which we term cake." Our author forgot the butter! But, seriously, while the use of such a homely and irrelevant illustration may be of advantage in the classroom, the wisdom of including it in a textbook is questionable.

In Chapter III, entitled Energy, the author by many examples works out the idea of energy, and suggests that the unit of energy should be termed the kelvin whether the "energy be in the form of work, heat or electricity." This idea is enlarged upon in the following chapter, and enforced by working out several problems. We also learn that 1 kelvin = 1 KW.-hour = 1,000 siemens, so that 1 siemens = 1 watt-hour.

The portion dealing with the magnetic field and conductors moving in such a field is very well worked out and fully illustrated by diagrams and folding plates. Indeed, the number of illustrations and folding plates throughout the volume is a striking feature, there being 115 in all.

In the alternating-current section all the main points are clearly dealt with. Here the author follows Prof. Kapp's nomenclature in designating the maximum instantaneous value of an alternating current or pressure, the "crest" value. Power factor loses its difficulty completely under the author's treatment, and the relationship between resistance, inductance and impedance is made quite clear. It would have been better if the author had introduced the familiar right-angled triangle to explain the manner in which the formula $U = \sqrt{R^2 + S^2}$ on page 123 is obtained, while leaving the full explanation of it to the following chapter.

The final chapter on Insulating Materials, already referred to, introduces the student to a most interesting portion of the book, where a great deal of useful information is contained, both in the text and in various curves. This is a subject which the average text-book generally ignores completely, although it is one of the most important factors in commercial undertakings.

The book is a very useful and instructive one in many ways, and ought to be of great service to a certain grade of student. The method of treatment is so novel, however, that the reviewer would hardly venture to place it in the hands of the average student except as a supplement to a less original text-book.—J. D. M.

An American Accidents Commission.—The National Association of Manufacturers, an American organisation of more than 3,000 members, among whom are included the largest industrial corporations in the United States, has recently taken up the important questions of prevention of accidents and industrial indemnity insurance, and has sent a Commission abroad to study methods and practice in Europe and Great Britan. The Commission, which is the first of its kind organised by any American industrial association to study the above subjects, left New York City on July 14th direct for Bremen. There are two members, Mr. F. C. Schwedtman, who is chairman of the Association's Committee on Industrial Indemnity Insurance, and Mr. James A. Emery, the general counsel and legal adviser of the Association. The Commission will establish headquarters in Berlin and London. Investigators and actuaries will be appointed in both places, and from these centres the Commission will investigate conditions in important cities. Special attention will be given to the museums of safety devices in Berlin, Munich and the Hague. The prevention of accidents will form one of the most important subjects to be studied. The Commission believes that fully 50 per cent. of industrial accidents are preventable, and that the scientific and practical application of safety appliances is of the utmost importance, not only from a humanitarian point of view, but also because of national, civic and individual economy. It is stated that cordial and intimate relations have already been established with the leading Continental professors of industrial economy and the heads of the great industrial associations both on the Continent and in England.

COAL-CUTTING MACHINERY AND ELECTRICAL ACCIDENTS IN MINES.

The reports of H.M. Inspectors of Mines for the year 1909, which have just been issued, form useful reading for all who are in any way interested in the application of electricity to the mining industry, as they clearly show the progress being made in the use of electrically-driven machinery; the reports of the accidents caused by its use, supply useful information as to the conditions under which the machines work, and the precautions to be taken in order to render such accidents less frequent.

As regards the output of coal for the year, the aggregate shows an increase of 2,228,123 tons, but the operation of the Eight Hours Act has caused a serious diminution of output in some of the principal coal districts. The use of coal-cutting machinery likewise has not progressed so much as one might expect; in fact, in some districts, notably that of Durham, the electrically-driven machines are fewer, and though no reason is given for their decreased use, we are very much afraid it is mainly due to apprehension of danger, which again is mainly founded on accidents that have already occurred, and which the managers are not competent—for want of electrical training—to explain and deal with. There is also probably some hesitation in dealing with electricity until it is known what the outcome of the Electrical Committee at present dealing with electricity in mines is likely to be. No doubt if the suggestions of the Committee, which in all probability will be embodied in the Special Rules, are onerous, managers of mines will seriously consider the advisability of withdrawing electrical coal-cutters from the face. It behoves, therefore, everyone interested in the question to do all that can possibly be done to prevent this, as we are convinced the electrically-driven coal-cutter can be rendered as safe and as secure from danger as a compressed-air machine, if only a little patience and a reasonable amount of care is exercised in the selection of men working the machines, and in seeing that the machines themselves are well designed in all the little details and that they are well looked after by someone who knows something about them.

The following table shows the actual output of coal, together with the number of machines working, and the proportion of coal won by them for the different districts. It also gives the number of face conveyors at work, but the records do not show whether these are driven by electricity or compressed air. In most cases, however, there is no doubt they are electrically operated:—

less. This is to some extent explained by the fact that the electrical machines are, with the exception of 10 rotary headers, all longwall coal-cutters, whilst nearly one-half of the compressed-air machines are percussive heading coal-cutters. The next table shows this more clearly:—

Analysis of Longwall Coal-Cutters in Use.

—	Electrical machines.	Compressed-air machines.	Difference in favour of electrical machines.
Disk	439	408	31
Bar	239	37	202
Chain ...	89	11	78
Total ...	767	456	311

Four of the machines, viz., two in No. 5 District and two in No. 11 District, are given in the Inspector's Reports as electrically-driven percussive machines; but this is evidently an error, as there is no electrically-driven percussive machine on the market, with the exception of an American machine which has a small electrically-driven air-compressor attached to it, so that the cutter is really worked by compressed air, though initially, of course, it is operated electrically. In the first table these have been included in the rotary heading machines.

The foregoing, however, is ample proof of the great superiority of electricity for driving coal-cutters over compressed air, and a little more confidence in their reliability and safety is only required for a greatly extended use of these machines. This is evidenced by the fact that in No. 2 District there was a decrease in the number of machines in use of 16, as compared with 1908, but there was an increase of 248,150 tons produced by electrically-operated machines, and a decrease of 286,604 tons by compressed-air machines; and in No. 5 District there was an increase of 12 electrical machines and a decrease of 24 compressed-air machines. In No. 8 District there was an increase of 15 electrical machines against seven worked by compressed air; and, again, in No. 12 District, where there were 24 machines in use as against 15 for 1908, each electrical machine averaged 6,659 tons, against 2,928 tons for each compressed-air machine. On the other hand, in No. 7 District, Sir Henry Hall, states:—"The number of compressed-air machines has increased, whilst electric driven machines are fewer. Probably compressed-air machines are, in the long run, as economical as those using electricity for motive power." From what has been shown above, however, it is evident that electricity must have some great advantage over

Particulars of Coal-Cutting Machines and Quantity of Coal Produced.

District.	Total output of coal. 1909.	Total output of coal. 1908.	Coal-cutting machines.									Statute tons cut by machines.		No. of face conveyors at work.
			Electrical.				Compressed air.							
			Disk.	Bar.	Rotary heading.	Chain.	Disk.	Bar.	Chain.	Rotary heading.	Percussive heading.	Electrical.	Compressed air.	
1. East Scotland	20,417,254	20,112,674	128	66	—	4	66	—	—	—	19	1,811,099	793,232	30
2. West Scotland	19,315,120	19,045,551	83	58	—	12	34	—	1	1	17	1,610,012	238,421	44
3. Newcastle ...	29,785,150	28,854,062	20	17	—	8	35	3	—	—	140	468,067	767,114	28
4. Durham ...	27,784,917	27,218,457	28	28	3	8	16	5	2	—	45	511,523	444,281	6
5. Yorkshire and Lincolnshire...	35,894,776	34,927,601	95	8	2*	18	87	6	—	—	42	1,211,762	1,619,551	17
6. Manchester and Ireland ...	11,204 771	11,436,118	8	5	—	1	26	—	1	—	84	111,442	232,571	20
7. Liverpool and North Wales...	16,092,186	16,443,186	9	4	—	—	75	6	—	—	45	110,482	922,755	1
8. Midland ...	35,085,633	35,229,641	48	25	3	30	56	8	—	10	15	1,122,882	933,602	7
9. Stafford ...	15,066,091	15,257,183	18	6	—	1	4	—	3	3†	18	292,833	136,994	—
10. Cardiff ...	24,805,769	24,708,294	—	6	—	—	8	5	4	—	4	39,186	116,626	3
11. Swansea ...	12,353,811	12,484,041	—	9	2*	7	—	3	—	—	3	105,549	23,426	4
12. Southern ...	15,831,701	15,692,248	2	7	—	—	1	1	—	—	12	62,904	31,588	17
Totals ...	263,637,179	261,409,056	439	239	10	89	408	37	11	14	444	7,457,741	6,260,161	177

* These are given as "percussive" in Mr. Pickering's and Mr. Lewis's report.
† Two of these machines were only in use for two weeks, and the other one for two months.

The total number of electrically-driven machines is 777, whilst the total number of compressed-air machines is 914—137 more—yet the coal produced by them is 1,197,580 tons compressed air, or we should not find 311 more electrical coal-cutters than of the latter type, and there is no doubt that this advantage lies in the economy and flexibility of

the transmission of the power. In his opening remarks, however, Sir Henry states :—"The use of coal-cutting machines makes a larger output possible from a more limited area of working face, and in thin hard seams effects a considerable economy. One of the larger firms in this district have 47 of these machines at work, and by this means undercut or hole, ready for breaking down and filling out, what is represented by a production of 367,955 tons per annum. The managers of these collieries express themselves as satisfied with the practical results obtained by machine coal-cutting, and are disposed to rely more and more upon that method in preference to manual labour. The machines employed by the firm in question are all actuated by compressed air, which, apart from the question of safety, are found to be less costly to keep in repair than where electricity is the motive power. Compressed air coal-cutting machines might apparently be applied more economically if advantage was taken of the electric haulage motors to work compressors underground. These motors are not required for haulage during the night, and they are thus at liberty to be coupled up to air compressors. I suggest to those employers working mines where, for various reasons, it is undesirable or impossible to utilise mechanical power for undercutting, that they might gain a considerable advantage under the new Regulations as to hours of work, if they set apart a body of men to work *in the night or late evening*, whose operations should be confined exclusively to holing or undercutting the seam. Thus a long face might be prepared in the same way as the machine prepares it, ready for the loaders-up in the day shift. By this means the legal eight hours day could be made more productive, as at least one-third of the total labour at the face would have been accomplished without encroaching on that period." This extract is given at length, not because of Sir Henry Hall's remarks against electrical coal-cutters, but to show that even when these are not desirable in the face, yet electricity is recommended for driving the air-compressors, and further to show the necessity of having as much coal undercut, or holed, during the night shift, ready to be filled away during the day; and Sir Henry would be the first to say, "Put in coal-cutters if you possibly can." There is one thing certain—if it will pay to put special men on to hand-hole or kirve the coal, there ought to be a handsome return on capital invested in coal-cutting machinery. Again, Sir Henry has a great respect for electric haulage, which "is becoming very general in the mines, and greater care and skill have been exercised in the more recent installations. Electric power has great advantages; it is easily applied and very reliable, and where the mineral is being worked at long distances from the shaft, the haulage can be done in steps, thus avoiding the necessity of using very long and heavy ropes."

In No. 5 District the operation of the Eight Hours Act "has increased the difficulties of machine mining, especially in longwall faces," so much so that the tonnage fell by 29,028 tons. Yet in the district there is an increase of 12 electrical coal-cutters, with an increased output of 45,443 tons of coal, whilst the decrease of 24 compressed-air machines accounts for the reduced tonnage of :—

Coal	...	...	...	50,301 tons
Fireclay	...	...	...	4,118 „
Ganister	...	...	...	20,052 „

Mr. Pickering, however, still speaking of the effect of the Eight Hours Act on coal-cutting machinery, goes on :—"The reason is quite obvious; one day everything goes well, and the required length of face is cut in less than eight hours. The next day there may be many unavoidable delays and difficulties, and at the end of the eight hours the 'cut' is not finished. Unless the machine is worked overtime there will be a block in the face. In some cases extra men have been employed and extra machines used to overcome these difficulties; but, nevertheless, the tonnage of machine-cut coal has fallen by 29,028. Previously, machine mining was rapidly developing in Yorkshire."

The effect of the Act in Yorkshire may be summarised as follows :—

1. It has shortened the working hours of many of the underground workers, especially haulage hands.
2. The weekly earnings of many persons have been reduced.
3. It has caused better order and discipline to be observed in some cases on the pit banks and pit insets, when men are being raised and lowered.
4. It has increased the difficulties of machine mining.
5. It has had the temporary effect of increasing the number of accidents.

Such are the blessings thrust upon the people by a beneficent Government.

(To be continued.)

PROCEEDINGS OF INSTITUTIONS.

The Electrification of Railways.

At the London joint meeting of the Institution of Mechanical Engineers and the American Society of Mechanical Engineers on Friday last, a series of papers relating to the electrification of railways was discussed.

Mr. George Westinghouse, President of the American Society of Mechanical Engineers, urged the necessity for the selection of a system for universal use. He pointed out the difficulties which had been experienced in the early days of steam railways through difference of gauge, and the resulting burden of lost capital which was felt to the present day; the tendency appeared to be towards diversity rather than uniformity, even the D.C. systems in and about New York City being equipped with different types of third-rail construction. The problem of electrifying standard railways was no longer the engineering problem of developing a locomotive and an electrical system, but a broad question of financial and general policy, having in view the future electrification of railways in general, and requiring a combination of the highest engineering and commercial skill.

In addition to the use of standard gauge of track, interchangeable couplings, brake and heating apparatus, and a uniform system of signalling, Mr. Westinghouse considered that electrically-operated railways required a supply of electricity at uniform pressure and frequency, standard position of working conductors, and uniform controlling apparatus to enable two or more electric locomotives or motor-cars to be controlled from one point. He then compared the three well-known systems which are in successful operation, pointing out that the choice must be based upon a comparison of the complete systems, not the locomotives alone. Disclaiming any bias in favour of any particular system, Mr. Westinghouse summarised the requisites for a universal electric system as follows :—

The electric locomotives should be capable of performing the same kinds of service as the steam locomotives now perform, practically duplicating the latter in speed and power characteristics; they should be capable of exceeding steam locomotives in power, and of operating at higher speeds. The electric system should be adapted to the requirements of branch lines and light railway service. Power should be transmitted economically over long distances and supplied to the contact conductor, with the aid of the most highly perfected apparatus. The contact conductor should be economical to construct, whether for the heaviest traffic or for light service; it should impose the least inconvenience on track maintenance, and the least probability of derangement in case of accident, with the maximum assurance of continuity of service.

The paper was accompanied by five appendices, giving particulars of the single-phase system of the New York, New Haven and Hartford Railroad, data of American electric locomotives, graphic comparisons of the various electrical systems, data of heavy railway services in which electricity is used, and the early history of the single-phase system.

Mr. W. B. Potter, of Schenectady, dealt with the "Economics of Railway Electrification." He attached importance to the questions of depreciation and running costs. The great difference in local requirements, he said, put uniformity of system of supply to the contact conductor out of the question; direct current at 600 volts or more was, in his opinion, the most economical for city and inter-urban service, and for the electrification of steam railways where the density of traffic was great enough to call for a relatively large investment in rolling stock as compared with the distributing system, single and three-phase equipments being applicable only to exceptional conditions, on account of their greater first cost. The equipment of the rolling stock might, in fact, be a more important factor in the economy of investment and operation than the scheme of power distribution. In America the three-phase system would probably be restricted to grade work, where its regenerative feature would prove of value. The relative economy of the various systems depended on the density of traffic and the character of power available rather than on the length of the railway. For single-phase operation a frequency of not more than 15 cycles was desirable; this being granted, the energy consumption on trunk line service would be nearly the same with single-phase as with direct current. The following table of costs was given :—

Reasonable Values for Trunk Line Service Sub-Stations.

—	600 v. D.C.	1,200 v. D.C.	11,000 v. one-phase.	11,000 v. three-phase.
First cost per KW., complete	$26	$28	$11	$12
Comparison of installed KW., per cent.	200-250	100-125	100	100-125
Load factor, machines in service, per cent.	20-40	35-70	40-80	30-60
Average efficiency, per cent.	78-88	87-92	97-98	97-98
Yearly operation and maintenance, each station	$5,000	$5,000	$2,500	$2,500

Contact Conductors.

—	Third rail.		Overhead.	
First cost, per mile	$5,000 to 7,000	$5,500 to 7,500	$3,500 to 7,000	$4,500 to 8,000
Efficiency, per cent.	88-92	90-96	93-97	93-97
Maintenance per mile per year	$75-125	$100-150	$100-200	$125-250

Rolling Stock.

—	600 v. D.C.	1,200 v. D.C.	11,000 v. one-phase.	11,000 v. three-phase.
Locomotives.				
First cost, each	$44,000	$47,500	$64,000	$58,000
Weight, tons (2,000 lb.)	125	125	160	160
Average efficiency, locomotive wheels to trolley, per cent.	85	85	79	81
Maintenance per locomotive per mile, cents	4	4	8	5
Motor-cars (complete).				
First cost, each	$12,000	$13,500	$20,000	—
Weight, tons (2,000 lb.)	43	44	54	—
Average efficiency, wheels to trolley	82	81	73	—
Maintenance per car-mile, cents	2	2·2	3·5	—

Local conditions affected the choice of system as follows:—

Grades exceeding 1½ per cent.	A.C.	preferable.
Heavy train units	A.C.	,,
Light trains, or multiple-unit operation	D.C.	,,
Infrequent service	A.C.	,,
High schedule speed and short runs	D.C.	,,

The simplicity and high pressure of the single-phase system were attractive, but the first cost and maintenance of the A.C. motor were against it, and he considered that the comparative results obtained up to the present were in favour of direct current. For trunk line service 1,200-volt D.C. would prove economical in some cases, but for a heavier intermittent service a higher pressure was necessary; whether this should be 1,800 or 2,400 volts D.C., or 11,000 volts A.C., could not be arbitrarily decided.

For interurban service the single-phase system had been practically abandoned for new work in the U.S.A., owing to the excessive weight and cost of rolling stock, high cost of maintenance, increased power consumption, and rapid depreciation of motors and rolling stock. For this type of service 1,200 volts D.C. had been adopted, as the motors wound for 600 volts could be used over existing trolley systems without difficulty. Data were given for an interurban railway 100 miles long with cars in each direction every hour, a condition favourable to the single-phase system; schedule speed, 33 M.P.H.; average distance between stops, three miles. The leading results were as follows:—

Extra maintenance of track, shop facilities for repairs, and greater skill in superintendence required for the single-phase system, would increase the cost of the latter by at least 1 cent per car-mile. Under the conditions stated, even 600-volt D.C. is more economical than single-phase, and with greater density of traffic the gain of D.C. over A.C. would increase. The conclusion was that the saving effected by the 1,200-volt D.C. system in interurban service was so great that a great increase in its adoption might be anticipated, and the single-phase system might be discarded for this purpose in America. Electric traction had proved in practice more reliable than steam, and could haul heavier trains on a faster schedule. Electric locomotives were under consideration, which, as single units, would exert a maximum tractive effort of 90,000 lb., and maintain a tractive effort of 35,000 lb. at 30 M.P.H.

Table Relating to Typical Interurban Electric Service.

	600 v. D.C.	1,200 v. D.C.	6,600 v. A.C.
Number of cars	15	15	18
Weight each car, tons (2,000 lb.)	35	36	43
Car-miles per day	3,000	3,000	3,000
Estimated maintenance per car-mile, cents	1·70	1·77	2·75
Kilowatt-hours per car-mile at car	2·8	2·88	3·78
Cost, each car complete	$10,000	$11,500	$17,000
Number of sub-stations	9	4	2
Peak load, kilowatts	416	448	670
Average load, each sub-station, kilowatts	52	120	275
Average efficiency	0·76	0·87	0·96
Cost each sub-station complete	$24,000	$26,400	$10,000
Cost overhead construction per mile	$2,300	$2,100	$1,900
It is assumed that power is purchased at 1 cent per kw.-hr.			
Total kilowatt-hours per day at cars	8,400	8,650	11,400
Combined efficiency	0·64	0·74	0·85
Kilowatt-hours per day at power house	13,100	11,700	13,400

Comparison of Cost of Systems.

	600 v. D.C.	1,200 v. D.C.	6,600 v. A.C.
1. First cost	$720,000	$612,500	$694,000
2. Fixed charges	$81,200	$70,600	$88,400
3. Operation and maintenance	$95,800	$82,300	$104,000
4. Annual cost (Item 2 plus Item 3)	$176,000	$152,900	$192,400

The capacity of terminals in large cities could be greatly increased by electrification, and economy in operation could be secured by proportioning the number of cars in a train to the requirements of the service during the day.

Mr. L. R. Pomeroy, of New York, discussed the electrification of trunk lines. He expressed the view that whether electricity would replace steam or not was entirely a commercial problem; no case for electrification could be made out unless an increase in the net receipts could be secured more than sufficient to pay interest on the extra capital involved. But there was hardly a railway in existence which had not some sections where local traffic could be handled more profitably by light and frequent electric trains than as at present, with heavy steam trains. A great advantage of the electric locomotive was its ability to maintain a draw-bar pull independent of the critical speed to which the steam locomotive was subject, due to the limitations imposed by the boiler. The coal consumption with electric traction was about 4 lb. per KW.-hour at the rail, whereas the steam locomotive consumed in all 6 or 7 lb. per I.H.P.-hour at the rail. Other authorities gave 3 lb. per KW.-hour at the draw-bar, and a cost of 1¼ cents per KW.-hour at the rail was, in the author's opinion, a conservative figure. Under ordinary circumstances the cost of fuel with electrical operation is half as much as with steam, and on steep grades the advantage is still greater, especially when the steam locomotives are not constantly running, as the large mallet locomotives, for instance consume 600 to 800 lb. of coal per hour when standing by. The cost of electrical energy is independent of the power demand, whereas with steam the cost of energy increases with the load on the locomotive. Mr. C. L. De Muralt finds that on the Pacific Railroad a saving of 4¾ million dollars would be made by electrification, on a total operating cost of 65 millions, and corresponding figures on the New York Central; but these savings would not amount to more than 2½ or 3 per cent. on the cost of electrification. The cost of repairs would be reduced by 60 per cent. It is claimed that the ordinary freight locomotive runs only 100 miles per day, whereas the electric locomotive can perform practically continuous service, so that fewer units suffice for the same service; however, the author states that the limitation is due to operating and traffic conditions which would apply equally to the electric locomotive. Electrical operation is only justified where the local passenger traffic is congested, and there is also scope for increase of traffic by electrification.

The power station capacity required would be far less than that of the locomotives employed, corresponding in fact to the average load, which can be determined from traffic data. The necessary provision can be found from the total train miles per hour divided by the mean speed, which gives the equivalent number of trains in motion, though the actual number in a typical case is shown to be nearly four times as great. The conditions are materially affected by the distribution of the traffic; electric traction has proved its superiority for distributed loads, but concentrated loads are still handled almost exclusively by steam locomotives.

Where goods traffic is dense, causing excessive costs per ton-mile, the speed must be increased, and this can best be effected by electricity, owing to the great power required from the locomotives. The New York Central electric locomotive can give a maximum of 3,000 H.P., or about twice that of the standard Atlantic type of steam locomotive. The great overload capacity of the electric locomotive is a strong point in its favour for special cases, such as short mountain grades or for "strategic peaks."

The author's conclusion is that the rapid development of suburban passenger traction by electricity will require large power houses at large cities, which can gradually be made sufficient for working the line on further stretches in each direction, until it may be desirable to electrify the whole division. Electrical opera-

tion in comparison with steam, shows to the greatest advantage in urban and suburban passenger service, where it makes possible a schedule speed quite unattainable by steam, as well as a more frequent service without a proportional increase in expense. A number of examples from practice are given, with extracts from published statements on the subject.

The cost of electrically-propelled suburban trains was the subject of the paper by Mr. H. M. Hobart, of London.

Were it not for conditions relating to the large amount of capital already invested in steam railways, it is certain that the merits of electrical methods would, so far as concerns suburban passenger traffic, lead to their general adoption.

For not applying electrical methods to other classes of railway traffic there is, so far as relates to Great Britain, the best of all reasons, namely, that steam is, at present, in almost all instances, more economical. In countries where coal is scarce and water-power abundant, the general electrification of the railways may be a thoroughly sound proposition.

In view of the circumstances, the question of the relative cost of various electrical systems of operating suburban lines becomes one of great importance. The two systems which are, at the present time, chiefly commanding attention, are the systems employing on the trains continuous-electricity motors and single-phase motors respectively. With a view to concentration, only these two systems are taken into account.

It is highly probable that for some long time to come, at any rate, a railway would, in many cases, be best serving its own interests by purchasing its electricity from electricity supply undertakings. The author in this investigation assumes that the railway not only purchases its electricity from independent undertakings, but that it looks to these independent undertakings to provide transmission lines and sub-stations; the railway is, however, the proprietor of all cables and structures intermediary between the sub-stations and the trains.

Prices arrived at by experience on a large scale are now quite well agreed upon for electricity.

The cost of the structures along the line, intermediary between the sub-stations and the trains, is assumed to be the same for both systems.

The author confines his comparisons chiefly to trains consisting of three double-bogie coaches. The cost of the electricity required for the propulsion of the trains, together with capital charges, including depreciation, repairs and renewals, make up an aggregate per train-mile which is usually of the order of from 35 to 40 per cent. of the amount of the gross receipts. The disposition of the remainder of the gross receipts will be substantially the same, whichever system is employed.

The severity of a train service is a function of the schedule speed and of the distance between stops.

The author analyses the design and performance of two 150-ft. trains designed for about the same "average output," and similar as regards the capacity and distribution of the electrical equipment. Only two motors are employed, driving two of the four axles of a motor-coach. Each train comprises three 50-ft. coaches—one motor-coach and two trailers. Type A is employed on the Piccadilly Tube Railway in London, and weighs 61 tons; type C is employed on the Heysham, Morecambe and Lancaster Branch of the Midland Railway, and weighs 77 tons. The service for which the 61-ton Piccadilly Tube train is employed requires a schedule speed of 16·4 miles per hour, and the runs are of an average distance of 0·45 mile between stations. The 77-ton Heysham train has a schedule speed of some 31 miles per hour. and there is an average distance of 4 miles between stations. The average output to the axles is just about the same in the two cases. The average efficiencies of the electrical equipments do not differ by more than 5 per cent. at the outside, and the author has employed the mean value of 70 per cent.

For the 61-ton Piccadilly train, the output of the equipment, average over the entire time, including stops, is 87 H.P.; for the 77-ton Heysham train the corresponding figure is 90 H.P. The total weight of the electrical equipment in the two cases is 8·0 tons and 14·9 tons respectively. In each case the service is that for which the equipment was selected, and the ultimate temperature rise in regular service is of moderate amount. Average output in service per ton of electrical equipment: 10·9 H.P. for the Piccadilly train, and 6·04 H.P. for the Heysham train.

Two trains for more severe services are each 180 ft. in length, and are each composed of two motor-coaches and one trailer-coach. Each coach is 60 ft. in length. Each motor-coach is equipped with four motors, making up a total of eight motors per train. Thus, eight of the 12 axles of the train are driven by motors. Type B is employed on the Southport line, and D is one of the trains now operating on the South London Elevated Railway. The weights are respectively 118 and 138 tons. The Southport train runs at a schedule speed of 30 miles per hour, and the average distance between stations is 1·32 miles. The South London Elevated train, which is designated the S.L.E. train, runs at a schedule speed of 22 miles per hour, and the average distance between stations is 0·88 mile. The power required at the axles in the case of the Southport 118-ton train is 42 per cent. greater than for the S.L.E. 138-ton train, notwithstanding the 18 per cent. greater weight of the latter train, and the power required at the axles, per ton of total train weight, is no less than 65 per cent. greater for the Southport service than for the S.L.E. service.

The weights of the electrical equipments in the two cases are 30 and 44 tons respectively. The average horse-power output to the axles per ton of electrical equipment, works out respectively at 10·6 H.P. for the Southport train, and 5·12 H.P. for the S.L.E. train.

The equipments were supplied by four different manufacturers who are amongst the half-dozen firms who probably have the greatest experience in the manufacture of electric railway equipments. Denoting the four examples as A, B, C and D, we arrive at Table I.

TABLE I.

Example.	Average output per ton of electrical equipment. H.P.	Railway.	Manufacturer.
A	10·9	Piccadilly.	B.T.-H. Co.
B	10·6	Southport.	Dick, Kerr & Co.
C	6·04	Heysham.	Siemens.
D	5·12	S.L.E.	A.E.G.

The mean of the first two results is 10·8 H.P. per ton, and of the last two, 5·6 H.P. per ton. The reason for this difference in weight of about 2 to 1 is that in the first two cases the equipments are designed for, and operated with, continuous electricity, whereas the last two cases have equipments designed for, and operated with, single-phase electricity.

It has been asserted that notwithstanding that the single-phase equipment for a train required to perform a given service, weighs twice as much per H.P. as the corresponding continuous equipment, this does not seriously affect the total train weight, since the weight of the electrical equipment constitutes (it is alleged) only a small part of the total weight of the train.

Comparing trains B and D, the electrical equipment of the Southport train only amounts to 25·4 per cent. of the total weight, as against 32 per cent. for the much less severe S.L.E. service. It should be of interest to ascertain how a train of the "D" type would require to be modified in order to be suitable to perform the "B" service.

TABLE II.

System	Continuous		Single-phase	
Designation of train ...	A	B	C	D
Average output during service ... H.P.	87	319	90	225
Do. per ton weight of train ... H.P.	1·42	2·70	1·17	1·63

The values in the lowest horizontal line of Table II are the real criteria of the severity of the service, and we see that the Southport service requires 65 per cent. more average power per ton weight of train than is required for the S.L.E. service. For the Southport service, there must be provided 2·7 H.P. per ton weight of train. Since with single-phase equipment, we obtain 6 H.P. per ton of equipment, we shall require 0·45 ton of electrical equipment for every ton of total weight of train. Thus 45 per cent. of the weight of the train will consist of electrical equipment.

In order to work the S.L.E. 180-ft. train to the Southport schedule, its electrical equipment must be increased as regards its average output, from 225 H.P. to 462 H.P., or 105 per cent. The revised S.L.E. train weighs 171 tons, as against the Southport train's weight of only 118 tons, or 45 per cent. more, and would have to consist of three motor-coaches, in place of the two motor-coaches and one trailer which sufficed for the S.L.E. service.

Reverse the above process and adapting the Southport train to the S.L.E. service of 22 miles per hour and one stop every 0·88 mile, this service requires only 1·63 H.P. per ton of total weight of train. The weight of the electrical equipment of the revised Southport train, that is, of the continuous train capable of working to the relatively moderate S.L.E. service, is only 15·3 tons. To operate a 180-ft. train to the S.L.E. schedule, employing continuous equipment instead of single-phase equipment, would not require two motor-coaches, but the three-coach train would consist of one motor-coach and two trailers. This continuous-electricity train operating on the S.L.E. service is only required to give an average output of 168·5 H.P., or 75 per cent. of the average output required of the motors on the single-phase train.

The total costs of the four trains are made up as shown in Table III:—

TABLE III.

—	Continuous train for Southport service.	Continuous train for S.L.E. service.	Single-phase train for Southport service.	Single-phase train for S.L.E. service.
Trucks	£815	£770	£860	£815
Car bodies	4,320	4,320	4,320	4,320
Electrical equipment ...	3,750	1,910	9,630	5,500
Further costs	590	515	855	690
Total cost of train ...	9,475	7,515	15,665	11,325
Weight of train, tons ...	118	103	171	138
Cost per ton	£80·3	£72·7	£91·6	£82·1
Cost per foot	£52·6	£41·7	£87·0	£63·0
Weight per foot, tons ...	0·655	0·575	0·95	0·77

Since these trains have a seating capacity of, roughly, one seat per foot, the two lower horizontal lines in Table III also give a fair representation of the relative costs and weights per seat. Thus for so severe a service as that at Southport, the cost of a single-phase train works out to be 65 per cent. greater per foot of length than is the cost of a continuous train. For the much more moderate service of the S.L.E. line, the excess cost of the single-phase train per foot of length is only 51 per cent.

The energy consumed at the train is for a given service about the same per ton-mile whether the electrical equipment be continuous or single-phase.

The author gives figures relating to a hypothetical road, the engineers of which are engaged in determining :—

1. Whether to use the continuous or the single-phase system.
2. The schedule speed to be provided on various sections of line with various distances between stations.

TABLE IV.

Designating Number.	Length of train.	Average distance between stations.	Schedule speed.	System.
	Feet.	Miles.	M.P.H.	
I. }	180	1·32	30	{ Continuous
II. }				{ Single-phase
III. }	"	0·88	22	{ Continuous
IV. }				{ Single-phase

The comparison relates to four cases, I, II, III and IV, set forth in Table IV.

The results are given in Table V.

The gross receipts for three-coach trains on services of this character are usually of the order of from 40d. to 60d. per train-mile. In a case where the gross receipts are 50d. per train-mile, it is evident from the results in the lowest horizontal line of Table V that whatever be the net profits, they will be less if the single-phase system is used than if the continuous system is used.

Confining attention to the suburban traffic, it appears that while there may be a few services in which the margin in favour of electrification is great enough to stand the higher cost of the single-phase system, there are many in which the great difference which the author has shown as existing between the two systems would make all the difference between commercial success and commercial failure.

TABLE V.

Schedule speed miles per hour	30 M.P.H.		22 M.P.H.	
Average distance between stops	1·32 miles		0·88 mile	
Designating number	I.	II.	III.	IV.
System	Continuous	Single-phase.	Continuous	Single-phase
Total annual cost per train, for electricity	£2,970	£3,450	£1,920	£2,040
Annual charges for capital, depreciation, repairs and renewals, per train	£1,420	£2,350	£1,130	£1,700
Sum of above two annual outlays, per train	£4,390	£5,800	£3,050	£3,740
Cost per train-mile, for electricity	13·2d.	15·3d.	9·6d.	10·2d.
Annual charges for rolling-stock, per train-mile	6·31d.	10·43d.	5·65d.	8·55d.
Sum of above two outlays per train-mile	19·51d.	25·73d.	15·25d.	18·75d.
Amount by which the single-phase train costs more per train-mile than the continuous-electricity train	6·22d.		3·5d.	

The more severe the service and the more intense the traffic, the greater is the superiority of the continuous system. But it is also demonstrated that even for systems of such moderate severity as 22 miles per hour and one stop per 0·88 mile, and even when the intensity of traffic is only one train every 12 to 15 minutes in each direction, the superiority of the continuous system is still very substantial.

With the object of basing his comparisons on thoroughly authenticated cases, the author has taken for the continuous-electricity services, roads employing pressures of some 600 volts at the trains. There are, however, now a considerable number of roads employing a pressure of 1,200 volts with conspicuous success ; indeed, in some of these instances, single-phase equipments have been replaced by 1,200-volt continuous-electricity equipments. As early as 1904 the author (see the Electrical Review, Vol. 54, pp. 693-765) urged the advantages of doubling the customary pressure for continuous-electricity traction systems, and based his comparisons on the precise lines which are now being so successfully adopted. Upwards of a dozen roads have now adopted the 1,200-volt continuous-electricity system of traction. This system effects distinct economies over the 600-volt system and very appreciably accentuates the contrast between the continuous-electricity system and the single-phase system.

Mr. F. W. Carter, of Rugby, dealt with the electrification of suburban railways, remarking that the shrinkage of suburban traffic had for several years past proved a source of lachrymose complaint at many of the general meetings of our railway companies.

When the main routes of street traffic are worked by tramcars and the auxiliary routes by motor-omnibuses, the railways as at present operated are at a great disadvantage, and bid fair to lose most of their suburban passenger traffic. The second report of the London Traffic Branch of the Board of Trade gives the loss of passengers by five railways as upwards of 12 millions in 1908 as compared with 1907, and of 47 millions in 1908 as compared with 1902.

The railway companies affected appear for the most part undecided between allowing their short-distance traffic to go, employing their energies in fostering the long-distance traffic, and endeavouring to reduce the effective range of tramway competition by electrification of their suburban lines. The latter alternative, wherever it has been tried, has invariably succeeded in recovering a portion of the lost traffic, besides creating a more desirable traffic for longer distances by the improvement of facilities. Whilst it is by no means certain that local electrification would prove the best commercial policy in the case of all railways handling suburban traffic, it is the author's opinion that there is considerable scope for well-considered electrification schemes in this country.

It has generally been found hitherto that the increase in traffic due to electrification has exceeded the estimates formed of it. Thus at the February, 1905, meeting of the Lancashire and Yorkshire Railway Co., the chairman stated, concerning the electrified Liverpool-Southport line, that "the increase in the traffic had exceeded their most sanguine expectations." At the February, 1907, meeting of the North-Eastern Railway Co., the deputy chairman explained that in the last half of 1906 they had carried 4,195,339 passengers on the electrified lines, a total increase of 47½ per cent., as compared with the last half-year that steam operation was exclusively employed. At the last February meeting of the London, Brighton and South Coast Railway Co., the chairman announced that the increase in passengers on the elevated electric line between Victoria and London Bridge for the two months, during which the line had been open, was—as compared with the corresponding period of 1908-9—440,536, or 63 per cent.

The capital outlay and operating expenses can be closely approximated in any particular case ; the amount will depend largely on the difficulty of the proposed schedule. It is in the power of electricity to improve very greatly on the performance of steam trains ; but the greater the improvement, the higher the capital and operating costs, and the greater the attractiveness of the line. It is a matter of nice estimation and computation to determine what improvement of service will result in the greatest commercial advantage to the railway. The Tynemouth lines and the Liverpool-Southport line do not differ greatly in the distance between stops. The schedule speed is however considerably higher on the Liverpool-Southport line, and the effect of this on operating expenses is to some extent revealed in the statement of the Lancashire and Yorkshire chairman at the February, 1906, meeting, that the cost of electric working was slightly higher per train-mile run than that of steam working.

The electrification of a steam railway can, of course, be considered commercially expedient, only when the estimated net profit under electrical operation exceeds that under steam operation by more than the interest on the extra capital involved. It is chiefly the burden of capitalisation which limits electrification to lines of heavy traffic. In the Tynemouth electrification the capital burden is about 1·93d. per train-mile. In the electrification of the South London elevated line the burden is about 6·4d. per train-mile at present.

The capital burden in the case of the Mersey Railway has been given as 4·3d. per train-mile, and in the case of the Lancashire and Yorkshire electrified lines as about 2d. per train-mile. These two cases, of course, include the generating station, which is absent in the first two.

An indispensable requirement to the success of any system for working suburban traffic is immunity from all forms of breakdown competent to delay the service. In this respect modern electric railway apparatus leaves little to be desired. The author is indebted to Mr. James R. Chapman, late chief engineer of the Underground Electric Railways Co. of London, for the following figures, giving particulars of all delays on lines under the company's control for the month of December, 1909, Table I. The much greater loss of time on the Metropolitan District Railway, as compared with the Tube lines, is almost entirely due to the fact that District trains operate to a considerable extent over foreign lines, worked for the most part in the interests of steam trains.

The comparative immunity from breakdown is duly reflected in the low maintenance costs of the train equipments.

TABLE I.—Train Delays, December, 1909.

	District.	"Tubes."*
Total number of train-miles	401,295	499,908
Total number of delays (all causes)	303	44
Total time lost by delays, minutes	1,186	107
Total number of delays due to electrical troubles on the trains	54	21
Time lost due to electrical troubles on the trains, minutes	135½	75
Average mileage per train per day	185	194·85
Average delay per train per day due to electrical troubles on the trains, minutes	0·062	0·029
Average delay per train per day due to all causes, minutes	0·548	0·042

* *i.e.*, Baker Street and Waterloo Railway ; Great Northern, Piccadilly and Brompton Railway ; Charing Cross, Euston and Hampstead Railway.

In February last Mr. Chapman stated that the 10 District Railway electric locomotives, now five years old, made 1,300 miles per day at a cost of ½d. per mile for all maintenance and repairs. Two of them coupled handled a London and North-Western Railway nine-coach train to Mansion House far better than a steam locomotive had ever done. The maintenance cost was 1d. per train-mile. The North-Western costs for maintaining a steam locomotive were 4d. per mile ; the average cost for all English railways was 3½d. per mile.

The railways in this country, operated wholly or in part electrically, are 18 in number, working over a total of approximately

200 miles of route and 410 miles of track. The trains are worked by 87 locomotives and 821 motor-coaches. The aggregate nominal power of the driving motors is approximately 360,000 H.P., of which 184,000 H.P. is provided by one type of motor alone.

By far the greater portion of the electrically-operated traffic is worked by motor-coaches rather than separate locomotives. This method of operation is peculiarly adapted for working suburban railways, and will, no doubt, remain the standard. Most of the passenger coaches are of the saloon type.

Although most of the railways in this country employ the vacuum brake, the electric railways, with the exception of the Lancashire and Yorkshire and the Midland, have adopted the Westinghouse type of brake. The chief reason for this is that compressed air can be stored to take off the brakes at a moment's notice.

In suburban service the greater part of the energy expended is used in giving speed to the train, and is ultimately dissipated in the brakes. Other things being equal, therefore, the more frequent the stops, the greater is the energy required per mile, and the more difficult the service. The energy consumption per ton-mile, unless abnormal, is, in fact, a very good measure of the difficulty of a service.

An even better measure is the acceleration that would cause the train to reach a speed equal to the mean running speed in the distance between two stops. Let A, B, fig. 1, represent speed-time curves corresponding to two schedules, B being A magnified twice in every direction. The distance represented in B is then four times that in A. At corresponding points P on the two curves the acceleration, and therefore the tractive effort per ton, will be the same, and the power per ton, being proportional to the tractive effort and the speed, is twice as great in B as in A. The energy per ton between corresponding points P and Q, being proportional to power and time, will be four times as great in B as in A. But the distance is also four times as great, and thus the energy per ton-mile used in accelerating—probably some two-thirds of the whole—is the same for the two services. If the mean train-resistance per ton were the same for the two curves, the energy per ton-mile required to overcome the resistance would also be the same, and we might then assert that the total energy-output per ton-mile would be the same in the two cases. As it is, there is a small error affecting a comparatively small portion of the energy, but this is in general of little consequence, as in suburban service a ratio of four to one in distance with similar speed curves is, of course, a very exaggerated one. The acceleration referred to above, which will be called the specific acceleration of the schedule, is the same for the two curves, being the square of the mean running speed divided by twice the distance. The method is perfectly general: so long as the speed-time curves for two services are similar, the specific acceleration will be the same, and the energy output of the equipments practically the same. It follows that of two services, that having the higher specific acceleration may be expected to show the higher energy consumption per ton-mile. Also that if two services have the same specific acceleration but differ in energy consumption, the higher can be reduced, in so far as it is not due to lower equipment efficiency, by running so as to assimilate its speed-time curve to that of the lower.

The specific acceleration of a schedule is a better index of the difficulty of the schedule than the energy consumption, inasmuch as it is independent of the equipment efficiency and of the particular manner of running the schedule, in effect reducing equivalent services to the same mode of operation. This, of course, presupposes that the line is not specially graded to reduce the difficulty of operation.

The above is an application of a method which the author has more fully elaborated elsewhere. The following table gives some characteristic schedules arranged in order of difficulty as indicated by the specific acceleration.

TABLE II.

Line.	Average distance between stops. Ft.	Schedule speed. M.P.H.	Time of stop. Secs.	Average speed excluding stops. M.P.H.	Specific acceleration. M.P.H. per sec.
Liverpool Overhead	2,145	19·5	11	22·9	0·179
Liverpool-Southport ...	6,535	30	15	33·4	0·125
Underground, Inner Circle	2,555	15·7	20	19·2	0·106
Baker Street and Harrow ...	5,000	23	20	26·6	0·104
South London Elevated ...	4,540	21·5	20	25	0·101
Hammersmith and City ...	2,830	16	20	19·2	0·096
Central London	2,540	14·7	20	17·7	0·090
North-Eastern, Tynemouth	6,000	20·5	30	24·1	0·071
Mid., Heysham-Morecambe	23,500	26·7	120*	33·4	0·035

* Assumed.

A difficult service—in the sense of a service in which the specific acceleration is high—is one in which it is advisable, in the interests of low energy-consumption, to employ high rates of acceleration and retardation; in an easy service this is of smaller consequence, and hardly worth securing at the cost of heavy mechanical strains on the bogies, &c., with the great draught of power incident to the use of a high rate of acceleration. The tests on the Liverpool Overhead trains indicated a maximum rate of acceleration of 4·2 ft. per second², and this is perhaps as high as it is advisable to employ in service. The author has a record of a run actually made with a coach carrying a motor on each axle, in which an average rate of acceleration of 4·2 miles per hour per second was maintained until a speed of 21 M.P.H. was reached. The test was made with a view of showing the possibility of electrical equipments in this connection, and the acceleration was certainly faster than would be considered comfortable to passengers.

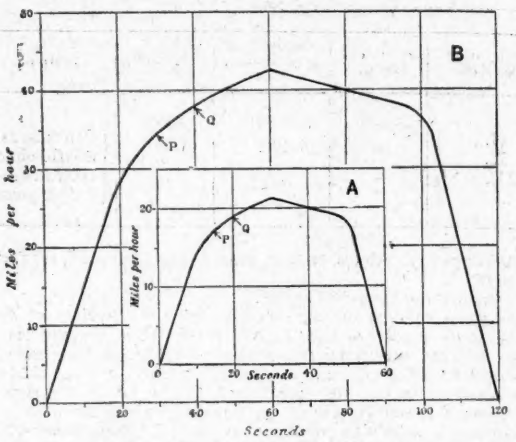


Fig. 1.—Speed-Time Curves corresponding to Two Schedules.

During the period of acceleration by controller notching, considerable energy loss is inevitable in the equipment. In the continuous-current system the average equipment efficiency during notching is usually only about 57 per cent., the remaining 43 per cent. being lost in the motors, rheostats, &c. It has been hastily assumed by some that the avoidance of rheostat losses in the single-phase system would result in much lower losses and higher mean efficiency during notching, but the authors of a recent paper on the Heysham single-phase system found that the mean efficiency of the equipment during notching was only 56 per cent. in the cases considered. The efficiency after notching is, of course, considerably higher for continuous-current than for single-phase equipments.

The claim that the performance of a suburban electric train can be very closely predetermined may seem an extravagant one, until it is considered how very few are the conditions on which it depends. The author's practice, in making a guarantee of energy-consumption, is to compute it as closely as possible under the expected conditions of test and to add 5 per cent. to cover bad driving and other unforeseen contingencies. Such a guarantee would, of course, be of little use unless accurate instruments were available for making tests. Train-testing instruments should be specially designed for the work, so as to secure exceptionally large torque and heavy damping.

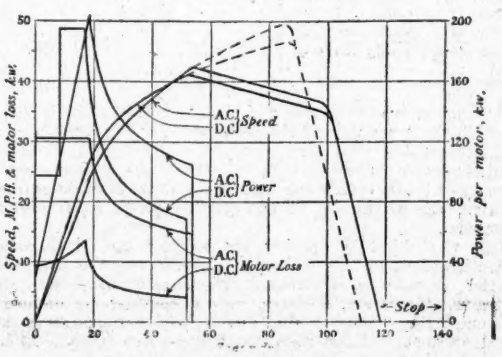


Fig. 2.—Train Characteristics.

These schedule calculations are easy but quite inadequate by themselves to determine whether an equipment is suitable for a given service. More important in this connection are the calculations involving the magnitude and distribution of the losses in the motors, with the facilities for transferring and dissipating the heat generated. It may be stated that the ultimate temperature rise of the hottest accessible part of an ordinary railway motor, totally enclosed and without forced ventilation, as measured by Centigrade thermometer after continuous service, is given approximately by:—

$$T = 7\,W\,w^{-\frac{2}{3}},$$

where W is the mean motor loss in service (not including gear loss) in watts, and w is the weight of the motor in lb., excluding gear and gear case. The motor losses in suburban service usually take from 6¾ per cent. to 7 per cent. of the input to the driving equipment in the continuous-current system, and from 15 per cent. to 18 per cent. of this input in the single-phase system. The great motor losses incident to the single-phase system form the foundation of all the objections raised to the use of this system for suburban service.

The heating of the motors has always been a limiting feature in the design of equipments for this class of service, and the practicable and desirable means of dealing with it are well understood. The use of forced draught for cooling the motors, whilst practicable for locomotives and single cars, is quite out of place on multiple-unit trains intended for suburban service, where, since the equipment may not be inspected for hours together, it cannot fail to lead to breakdown, increasing maintenance charges and causing delays to traffic.

Fig. 2 gives speed, power and motor-loss curves corresponding to typical suburban schedule runs with continuous current and with single-phase equipments, the former of which carries 20 tons per motor and the latter 23 tons. It will be seen that the great difference between the systems is in the motor loss, which amounts to 6·75 per cent. of the input in the continuous-current case and to 17·8 per cent. in the single-phase case. Although both motors are dynamically capable of working the service, the former alone has sufficient thermal capacity for the purpose, the other having to dissipate three times as much energy as it can get rid of by natural cooling.

The author has confined his remarks to the subject of "Suburban Electrification," inasmuch as there appears little prospect at present of general electrification of railways in this country. His investigations have convinced him that in this country at least, the commercial advantage is only demonstrable in general in the case of heavy suburban service. Where there is any considerable suburban traffic, an investigation of the cost of electrification and the economic results of providing improved facilities will repay the trouble and expense, and, in many cases, justify proceeding with the conversion.

It will be understood that the above remarks are intended to apply to the electrification of existing steam-operated lines. The case of entirely new railways is different and much more favourable to electrical operation. In laying out a new branch to an existing railway, it may be well worth while to consider electrical operation, the capital cost of which might be more than saved in the cheaper roadbed, since steep grades are much less objectionable on an electrical than on a steam road. Of course, there are likely openings for local electrification on existing railways even apart from suburban systems. It might, for instance, be found profitable to work the pushers on the Bromsgrove incline electrically. It is quite possible, again, that where electric power is already available at goods yards and docks, the shunting could be more efficiently carried out by specially designed electric locomotives, fed, perhaps, by a suitable surface-contact system, than by steam locomotives, that would seem to be uneconomical for such work. For ordinary main-line work, however, there is at present no indication that the steam locomotive can be superseded with advantage in this country.

The discussion was opened by MR. H. F. PARSHALL, who said that possibly Mr. Potter was the first authority on matters of detail in electric traction. The cost of transmission in this country, however, was certainly not a controlling factor in the choice of system, the Board of Trade Regulations being such as to render operation very expensive in this country. On the Central London Railway the energy lost in the system cost 15 per cent., maintenance 45 per cent., and the power house the balance of the cost of working the system, which showed that the cost of maintaining and running an elaborate system was out of all proportion to transmission costs. The figures given by Mr. Hobart showed that the excess of A.C. working cost over D.C. working cost more than covered transmission costs. His conclusion, after a recent visit to America, was that either system could deal with dense traffic better than steam working, but certainly the New Haven system would never have been allowed in this country, as everything which could have been done contrary to the Board of Trade Regulations in this country, appeared to have been done. The single-phase system was generally more expensive to work and install, but the choice of system depended on circumstances.

MR. J. DALZIEL (Midland Railway) considered that main line electrification was comparatively imminent, and that a suitable system must be considered for future use. He favoured the single-phase system, which had also found great favour on the Continent; granting that it had some disadvantages in suburban work, he did not see how it was possible to choose a system, with regard only to a small section of line. Without information as to existing railway conditions, it was impossible to form a correct judgment as to the demand for increased capacity. In view of the widenings which have taken place it was clear that some lines were approaching their maximum capacity, and he considered that the necessary added capacity could be obtained more cheaply by electrification than by doubling, or regrading. Speaking unofficially, he considered that the costs were overwhelmingly in favour of electrifying rather than regrading, for instance, the Midland Co.'s Derby-Manchester and Sheffield-Manchester sections. As regarding reliability, the Midland's Westinghouse single-phase equipment on the Heysham line had had only four breakdowns (of a minor character) in 2½ years. As regards energy requirements, the Liverpool-Southport trains had a consumption of 96 watt-hours per ton-mile, while on a similar schedule the Midland Heysham trains consumed 88 H.T. watt-hours per ton-mile, and with trains of similar accommodation, the respective power station outputs would be 1·25 to 1, D.C. to single-phase, the latter trains being 3·8 per cent. heavier. Mr. Hobart's paper hinged largely on his first table, which was based on a misconception of the Heysham service and led to wrong conclusions on his part. Actually the Heysham trains with Siemens equipment had an output per ton of electrical equipment of 8·83 H.P., or in the case of the Westinghouse equipment, 7·2 H.P. The figures for energy consumption given for the Piccadilly tube line were entirely in disagreement with those in Mr. Hobart's own book on "Electric Railway Engineering," and he (the speaker) estimated that the output per ton of equipment for that line should be 7·4 H.P., against the Heysham output of 8·83 H.P. Mr. Hobart appeared to have considered the total energy supplied to the line, making no allowance for lifts, ventilation, lighting, &c.

MR. STONE referred to the excessive track wear on electric railways in this country, which he put down to the pushing action of the rear motors in motor-car trains, when the front motors met extra resistance in the form of grades or curves. It seemed necessary that there should always be some excess of power at the front of such a train.

MR. C. F. SCOTT (past president, American Institute of Electrical Engineers) referred to the subsidiary advantages obtained by electrifying a railway, such as the possibility of double or treble-deck tracks, requiring less ground area, and the opportunity of building over tunnels, &c. It was admitted that the single-phase equipment was the more expensive, but the D.C. equipment required about 25 per cent. more energy for the same work at the car. Judging from Mr. Pomeroy's figures, the cost of D.C. power was 50 to 60 per cent. greater than A.C. power. He thought probably Mr. Hobart's figure of 5d. less per train-mile for the D.C. system as compared with the single-phase on similar work, should be nearer 2½d.—as slight differences in assumptions caused radical differences in the conclusions arrived at. From his experience the cost of equipping single-phase and direct-current systems worked out much the same.

The New Haven was the only real electrical trunk line in America, and that was a single-phase line, which was being extended on that system.

MR. PHILIP DAWSON telegraphed regarding Mr. Hobart's data for the South London line, that the weight of the electrical equipment was only 36 tons (as against 44 tons mentioned), and the watt-hours per ton-mile were only 66 (as against 79 in the paper). Moreover, six motors per train were quite satisfactory in running the trains (eight were mentioned), hence the conclusions arrived at by Mr. Hobart were quite erroneous.

MR. HOBART said he found himself very much in agreement with Mr. Potter's paper—but in one case referred to there was little to choose as regards the system of traction, and he thought, all things considered, he would have chosen a single-phase system. From the calculations in that case, he thought the single-phase system beat the D.C. system, and, when this was the case, one always found that steam traction was superior to both.

MR. J. G. WILSON said electrification could reduce the cost of working our heavy suburban roads; it provided the only effective means of competing with other systems of transport; and there were sections of heavy freight movement which it would pay to work electrically. He was in agreement with the spirit of Mr. Westinghouse's paper, but thought his proposals were impracticable and economically unsound. For instance, it could be shown that the cheapest system for dealing with the Great Eastern suburban traffic was by D.C. traction, but in the case of the adjoining Great Northern line, with its mineral traffic, it seemed probable that an A.C. system would be preferable. Now, which of these companies should give way in the interests of a common system of working? He didn't see how a uniform system could be used. To delay was wrong, because the advantages of waiting were problematical, while the present advantages of electrical working were real.

Brief replies were made to the discussion, and one speaker, hailing from across the water, justified Mr. Potter's conclusions in favour of D.C., pointing out that brush repairs were 100 to 1 against the single-phase system, and, despite the smaller sub-station requirements of the latter, the number of men employed on single-phase interurban lines in America was as great, or perhaps greater, than on direct-current roads.

MR. J. A. F. ASPINALL (President, Institution of Mechanical Engineers), in concluding, said he was glad to notice from the diagrams of American electric locomotives for heavy haulages, that they were reverting to steam locomotive practice in placing the centre of gravity high; the low centre of gravity found in some cars was a great defect. The Liverpool-Southport system was perfectly satisfactory, with the exception of the wear and tear of the motor machinery. No general manager of a railway could afford to disregard either system of electric traction. The small proportion of steam locomotive time used in useful work was well known, and he thought possibly there was as much money to be saved by utilising this wasted time as by adopting either system of electrical working.

Beckenham Lighting.—The accounts of the electricity undertaking for the year ended March 31st, 1910, were presented at the Council meeting last week, and showed that for the past year £4,072 was required for the generation of electricity, £421 in distribution, £1,231 in management expenses, making, with other items, £9,288 carried to net revenue account (repayment of loans, &c.), £15,841. The sale of current for private lighting brought in £10,811; public lighting, £345; current for tramways, £2,711; rental of meters and free-wired installations, £1,109. Mr. P. Sjollema, the chairman of the Electricity Committee, presented the accounts, and said there was a debit balance of £251 against £119 brought forward last year, showing the revenue account had suffered a loss of £131. Had there, however, been no law and Parliamentary charges, there would have been a profit of £11. The most satisfactory feature was the reduction in the cost of generation by £2,214, of which coal alone was responsible for £2,056. After making provision for interest and sinking fund, there was a saving of £1,168, but, owing to the use of metallic-filament lamps, they received £537 less for energy, although they had 184 new customers.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PORTUGAL.—It is imperative that the exact net and gross weights in kg. should be marked on each package, and specified on invoices, bills of lading, &c. The net weight in kg. of each class of goods should be stated, and the country of origin of the goods should be declared in all documents. Persons shipping goods to Portugal must draw up a declaration of cargo in duplicate, which must be certified by the Portuguese Consul at the port of shipment. This declaration must state the marks, numbers, quantity and descriptions of the packages, the gross weight, the description of the goods, the net weight, the value, the country of origin, and the name and residence of the consignee. The fee for certification of the declaration is 10s. The declaration is not required for goods not exceeding 45,000 reis (£10) value or 10 kg. weight. Copies of the declaration may be obtained from Messrs. Eden, Fisher & Co., 95-97, Fenchurch Street, E.C. *Ad valorem* duties are calculated on the value of the goods at the place of origin or manufacture, increased by the charges for freight, insurance and commission, and all expenses incurred up to the time of their entry in the Custom House where cleared.

Milreis = 1,000 reis = about 4s. Kg. = 2·204 lb.

	Reis per kg.
Steel wire	5
Copper, brass, &c., in wire	40
„ „ hammered or rolled, cast or scrap	5
Railway rails and fastenings	1·5
Iron wire, plain, polished, galvanised, &c.	2
Electrical apparatus and machinery, including submarine cables	30 % ad val.
Apparatus and machinery of all kinds not specified :	
Weighing up to 50 kg.	60
„ from 50 to 100 kg.	50
„ „ 100 to 500 kg.	40
„ „ 500 to 1,000 kg.	30
„ more than 1,000 kg.	20
Transmission belts for machinery	100
Steam generators	50
Instruments and apparatus for use in chemical laboratories	30
Surgical instruments and apparatus	30 % ad val.
Mathematical, astronomical and scientific instruments and apparatus not mentioned	15 % „
Instruments, implements and tools for arts, manufactures, &c.	60
Steam, gas and hot-air engines :	
Up to 30 H.P.	50
From 30 to 100 H.P.	30
Above 100 H.P.	20
Electric batteries, complete or not	300
Rolling-stock for railways not elsewhere mentioned	12 % ad val.
Caoutchouc and gutta-percha manufactured	600
Porcelain manufactures	300
Earthenware manufactures	200
Glass manufactures	300
Copper manufactures, not specially mentioned	400
Wire covered with caoutchouc or gutta-percha	40
„ „ tissue of any kind or with paper	550
Electric lamps	dutiable as material of which made.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

17,026. "Expanded spark ignition for internal combustion engines." J. F. FLOOD. July 18th.

17,047. "Improvements in or relating to electric fuses." SIEMENS-SCHUCKERTWERKE, G.m.b.H. (Application for Patent of Addition to No. 14,622, 1908. Date applied for under Sec. 91 of the Act, July 23rd, 1909, being date of application in Germany.) July 18th. (Complete.)

17,052. "Improvements in electric switches." C. H. MERZ. July 18th.

17,091. "Improvements in electrical measuring instruments." E. WESTON. July 18th. (Complete.)

17,110. "Improvements in electro-mechanical controlling devices." ADAMS MANUFACTURING Co., LTD. (Cutler-Hammer Manufacturing Co., United States.) July 18th. (Complete.)

17,126. "Improved electromagnetic separation drum or pulley." J. HAWLEY, LTD., S. H. SAUNDERS and A. S. JONES. July 19th.

17,141. "Gauge or indicator for denoting electrically any degree of vacuum or pressure or both." F. W. RICHARDSON. July 19th.

17,148. "Improvements relating to conduits or casings for electric conductors." W. E. MONRO. July 19th.

17,156. "Circuit-closing device for electric-signalling devices." ALLGEMEINE ELEKTRICITATS GES. (Date applied for under Sec. 91 of the Act, July 19th, 1909, being date of application in Germany.) July 19th. (Complete.)

17,166. "Improvements in or relating to starting devices for electric motors." ADAMS MANUFACTURING Co., LTD. (Cutler-Hammer Manufacturing Co., U.S.) July 19th. (Complete.)

17,177. "Improvements in protective devices for electric distribution systems." BRITISH THOMSON-HOUSTON Co., LTD., and J. WHITCHER. July 19th.

17,227. "Improvements in telegraphic apparatus." H. KNUDSEN. July 20th.

17,235. "Improvements in or relating to means for working two motor-controllers by a single operating handle or the like." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) July 20th. (Complete.)

17,236. "Improved device for grinding the contact surfaces of carbon brushes for dynamos or other purposes." A. WATKINS. July 20th.

17,249. "Improvements in automatic switchgear for controlling motor-driven planing machines and the like." J. G. STIRK. July 20th.

17,278. "Improvements in and relating to electrodes for arc lighting." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) July 20th. (Complete.)

17,312. "Improvements in ships' and analogous telegraphic apparatus." CHADBURN'S (SHIP) TELEGRAPH Co., LTD., and A. J. GRANT. July 21st.

17,322. "Improvement in printing telegraph instruments." E. J. KESSELS. July 21st.

17,330. "Improvements in electric generators." R. F. HALL. July 21st.

17,336. "Improvements in connection with batteries." M. HANNEMANN. July 21st. (Complete.)

17,341. "Improvements in motor controlling circuits." ADAMS MANUFACTURING Co., LTD. (Cutler-Hammer Manufacturing Co., United States.) July 21st. (Complete.)

17,340. "Improvements in motor controller circuits." ADAMS MANUFACTURING Co., LTD. (Cutler-Hammer Manufacturing Co., United States.) July 21st. (Complete.)

17,344. "Improvements in electric circuits, closers, or starters for use in connection with electromotors and the like." ELECTRIC AND ORDNANCE ACCESSORIES Co., LTD., and J. R. GARNER. July 21st. (Complete.)

17,349. "Improvements in and relating to controllers for use in connection with electric motors." ELECTRIC AND ORDNANCE ACCESSORIES Co., LTD., J. R. GARNER and M. R. H. MUELLER. July 21st.

17,369. "Improvements in electric lamps." H. P. BLECKLY. July 21st.

17,380. "Improvements in trolley guard attachment for electric tramcars." K. ENGEL. July 21st. (Complete.)

17,399. "New or improved construction of continuous-current electric generators and motors." J. ATKINSON. July 22nd.

17,415. "Improvements in prepayment electricity meters." CHAMBERLAIN AND HOOKHAM, LTD., and W. S. SPRAGUE. (Application for Patent of Addition to No. 3,250 of 1910.) July 22nd. (Complete.)

17,426. "Improved means for connecting electrical conduits to their fittings." W. B. INCLEDON and A. K. INCLEDON (trading as Electrical Conduit and Fittings Co.). July 22nd.

17,447. "New or improved portable apparatus for the softening and purification of water by means of electricity." D. L. V. BROWNE. July 22nd.

17,469. "Improvements in or relating to the manufacture of filaments for incandescing electric lamps." F. EISNER. July 22nd.

17,477. "Improvements in electric conductors." A. E. MAYOR. July 22nd.

17,482. "Improvements in and connected with current collectors for overhead electrical railways." F. W. TUCKER. July 22nd.

17,498. "Improvements in the method and means for changing the trolley connection upon electric tramcars and the like." R. S. CLAPHAM. July 23rd.

17,509. "Improvements in electric ovens." B. THOMAS and E. THOMAS. July 23rd.

17,523. "Improvements in and relating to telegraph relays." W. JUDD and A. R. HARDIE. July 23rd. (Complete.)

17,537. "Improvements in electric hot-air and steam heating and ventilating systems for railway carriages and the like." J. STONE & Co., LTD., and A. H. DARKER. July 23rd.

17,538. "Improved form of electrical cooking vessel." G. COOPER. (F. Boelling, Germany.) (Application for Patent of Addition to No. 21,494 of 1908.) July 23rd. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

APPARATUS FOR USE IN THE DISTRIBUTION OF ALTERNATING ELECTRIC CURRENT. A. F. Berry. 7,121. March 24th.

GENERATION, TRANSMISSION AND DISTRIBUTION OF ELECTRICITY. M. B. Field and Ferranti, Ltd. 12,685. May 28th.

ELECTRIC SWITCHES. R. P. Howgrave-Graham. 14,833. June 24th.

ELECTRICAL INDUCTION FURNACES. C. Grunwald. 14,937. June 26th. (Date applied for under International Convention, October 2nd, 1908. Application for Patent of Addition to No. 3,599 of 1909.)

APPARATUS FOR AUTOMATICALLY ESTABLISHING AND CUTTING OFF THE SUPPLY OF ELECTRICITY, GAS, OR OTHER FLUID. J. Hansford and J. E. Wright. 15,086. June 26th.

DYNAMO-ELECTRIC MACHINES CONSTRUCTED WITH COMMUTATORS. R. Pohl and Phœnix Dynamo Manufacturing Co. 15,319. June 30th.

MOTOR-CONTROL SYSTEMS AND ROTARY ELECTRIC TRANSFORMERS OR MOTOR-GENERATORS THEREFOR. Crompton & Co. and J. C. Macfarlane and H. Burge. 15,494. July 2nd.

MANUFACTURE OF ELECTRIC CARBONS. R. Lessing. 15,647. July 5th.

MEANS BY WHICH THE SWAYING AND SPINNING OF ELECTRIC SHADES ARE PREVENTED. G. Clarke. 20,342. September 6th.

AUTOMATIC SEQUENCE SWITCHING DEVICE AND ITS CONTROL. J. E. Kingsbury. (Western Electric Co.) 20,840. September 11th.

TROLLEY ARMS OR COLLECTORS FOR ELECTRICALLY-PROPELLED VEHICLES RUNNING WITHOUT RAILS. E. M. Munro and Railless Electric Traction Co. 22,087. September 28th.

ELECTRICAL CAPSTANS, ELECTRICAL CRANES, AND OTHER ELECTRICAL LIFTING, WINDING OR HAULING APPLIANCES. Royce, Ltd., and R. D. Hulley. 22,454. October 2nd.

TROLLEYS FOR USE ON ELECTRIC TRAMWAYS ON THE OVERHEAD CONDUCTOR SYSTEM. E. J. Fredericks, D. R. Fredericks, L. E. Russell, C. W. Wedding and J. Connelly. 23,604. October 14th.

ELECTRICAL FITTINGS, SUCH AS CEILING ROSES, FUSE BOXES, SWITCH CASES, AND THE LIKE. L. M. Waterhouse. 24,770. October 28th.

ELECTRIC FUSES AND DETONATORS FOR BLASTING AND THE LIKE. J. H. Robinson and Kynoch, Ltd. 28,532. December 7th.